

**ROADMAP FOR THE CONSERVATION  
OF THE LEOPARD IN AFRICA**

*(As at 31 October 2018/Prepared by the Secretary)*

**Summary:**

This document contains in its Annex a draft Roadmap for the conservation of the leopard (*Panthera pardus*), drafted under the framework of the African Carnivore Initiative (ACI).

This draft version is submitted to African leopard Range States for review at the 1<sup>st</sup> Meeting of Range States for the Joint CMS-CITES African Carnivore Initiative.

It will be finalized in December 2018, with the goal of submission to the CITES CoP18.

All representatives of the African leopard Range States and other participants at the ACI meeting are kindly invited to submit suggestion for changes or for complements to the Co-chairs of the IUCN SSC Cat Specialist Group until 1 December 2018.

# Roadmap for the Conservation of the Leopard in Africa

DRAFT Version 1.0 – October 2018



Compilation of available information on the status of the leopard *Panthera pardus* in Africa, review of threats and a proposal for a conservation programme in the frame of the joint CITES-CMS African Carnivore Initiative

CMS & CITES Logos?



# Roadmap for the Conservation of the Leopard in Africa

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## **DRAFT of Version 1.0 – October 2018**

**This draft version is submitted to the CITES and CMS Parties from Africa for review to be discussed at the CITES CMS African Carnivores Initiative meeting on 5–8 November 2018 in Bonn, Germany. It will be finalised in December 2018 to be submitted for the CITES CoP18.**

**All representatives of the lion Range States from Africa and other participants at the ACI meeting are kindly invited to submit suggestion for changes or for complements to the Co-chairs of the IUCN SSC Cat Specialist Group until the 1 December 2018.**

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# Contents

Acknowledgements.....	5
Acronyms.....	6
Country Codes .....	7
1. Introduction .....	8
1.1 Taxonomy.....	9
1.2 Distribution .....	10
1.3 Habitat, Ecology and Behaviour .....	10
1.4 IUCN Red List Assessment of the leopard .....	14
1.5 Threats and Conservation Challenges .....	15
2. Conservation status of the leopard in Africa .....	16
2.1 Distribution, status and conservation units .....	16
Transboundary (meta) populations .....	17
Conservation units .....	18
2.2 Leopard population status, estimations and trends per conservation unit .....	19
West Africa .....	200
Algeria.....	20
Benin.....	21
Burkina Faso.....	21
The Gambia.....	21
Ghana .....	21
Guinea .....	21
Guinea-Bissau .....	21
Liberia .....	22
Mali.....	22
Niger .....	22
Nigeria .....	22
Senegal .....	22
Sierra Leone .....	22
Togo.....	23
Central Africa .....	23
Cameroon .....	23
Central African Republic .....	23
Chad.....	23
Republic of the Congo .....	23
Democratic Republic of the Congo.....	24
Equatorial Guinea.....	25
Gabon .....	25
Ivory Coast .....	25
East Africa .....	26
Burundi .....	26

Djibouti .....	26
Egypt.....	26
Eritrea .....	26
Ethiopia.....	26
Kenya .....	27
Rwanda .....	277
Somalia .....	277
South Sudan .....	28
Sudan.....	288
Tanzania.....	288
Uganda.....	29
Southern Africa .....	29
Angola.....	30
Botswana .....	30
Eswatini (Swaziland).....	31
Lesotho .....	31
Malawi .....	32
Mozambique .....	32
Namibia.....	34
South Africa.....	35
Zambia .....	37
Zimbabwe .....	38
2.3 Use and trade.....	39
2.4 Threats .....	422
Habitat loss and fragmentation .....	42
Prey depletion.....	43
Conflict .....	44
Trophy hunting.....	45
Illegal killing .....	47
2.5 Monitoring, research and conservation .....	48
Surveys and monitoring.....	48
Research and conservation .....	49
West Africa .....	49
Central Africa .....	50
Southern Africa .....	50
East Africa .....	50
2.6 Gaps in knowledge and conservation challenges.....	51
3. Recommendations .....	53
Strategic planning for leopard conservation .....	53
Steps towards a leopard conservation programme.....	54
Conclusions.....	57
References.....	58

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## Acronyms

ACI	African Carnivores Initiative
ANAC	National Administration of Protected Areas
CARACAL	Centre for Conservation of African Resources: Animals Communities and Land use
Cat SG	Cat Specialist Group
CHA	Controlled Hunting Areas
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
DWNP	Department of Wildlife and National Parks, Botswana
GMA	Game Management Area
IUCN	International Union for the Conservation of Nature
MINUA	Ministerio do Urbanismo e Ambiente
NAP	National Action Plan
NDF	Non-Detriment Finding
NR	National Reserve
NP	National Park
PA	Protected Area
RCS	Regional Conservation Strategies
SSC	Species Survival Commission
WAP	W-Arly-Pendjari Complex
ZAWA	Zambian Wildlife Authority

## Country Codes (in accordance with [ISO 3166-1 alpha 3](#))

ISO 3166-1 alpha 3	English short name	French short name
AGO	Angola	Angola (l')
BDI	Burundi	Burundi (le)
BEN	Benin	Bénin (le)
BFA	Burkina Faso	Burkina Faso (le)
BWA	Botswana	Botswana (le)
CAF	Central African Republic	République centrafricaine (la)
CIV	Côte d'Ivoire	Côte d'Ivoire (la)
CMR	Cameroon	Cameroun (le)
COD	Congo (the Democratic Republic of the)	Congo (la République démocratique du)
COG	Congo (the)	Congo (le)
DJI	Djibouti	Djibouti
DZA	Algeria	Algérie (l')
EGY	Egypt	Égypte (l')
ERI	Eritrea	Érythrée (l')
ETH	Ethiopia	Éthiopie (l')
GAB	Gabon	Gabon (le)
GHA	Ghana	Ghana (le)
GIN	Guinea	Guinée (la)
GMB	Gambia (the)	Gambie (la)
GNB	Guinea-Bissau	Guinée-Bissau (la)
GNQ	Equatorial Guinea	Guinée équatoriale (la)
KEN	Kenya	Kenya (le)
LBR	Liberia	Libéria (le)
LBY	Libya	Libye (la)
LSO	Lesotho	Lesotho (le)
MAR	Morocco	Maroc (le)
MLI	Mali	Mali (le)
MOZ	Mozambique	Mozambique (le)
MRT	Mauritania	Mauritanie (la)
MWI	Malawi	Malawi (le)
NAM	Namibia	Namibie (la)
NER	Niger	Niger (le)
NGA	Nigeria	Nigéria (le)
RWA	Rwanda	Rwanda (le)
SDN	Sudan (the)	Soudan (le)
SEN	Senegal	Sénégal (le)
SLE	Sierra Leone	Sierra Leone (la)
SOM	Somalia	Somalie (la)
SSD	South Sudan	Soudan du Sud (le)
SWZ	Eswatini (Swaziland)	Eswatini (l') (Swaziland)
TCD	Chad	Tchad (le)
TGO	Togo	Togo (le)
TUN	Tunisia	Tunisie (la)
TZA	Tanzania, United Republic of	Tanzanie, République-Unie de
UGA	Uganda	Ouganda (l')
ZAF	South Africa	Afrique du Sud (l')
ZMB	Zambia	Zambie (la)
ZWE	Zimbabwe	Zimbabwe (le)



# 1. Introduction

The leopard has been on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1975 and since 2017 on Appendix II of the Convention on the Conservation of Migratory Species of Wild Animal (CMS). In the [IUCN Red List of Threatened Species](#), *Panthera pardus* has been listed as Vulnerable (Stein et al. 2016), based on the recently observed decline of the global distribution range of the species and the potential level of exploitation. In 2017, CITES and CMS launched the joint [African Carnivore Initiative](#) (ACI), which also covers the leopard for the African part of its range. The ACI intends to cooperate closely with IUCN, and the CMS Secretariat commissioned the IUCN SSC Cat Specialist Group to draft a Roadmap for the *Conservation of the Leopards in Africa* as an input document to the first Range State Meeting of the ACI in November 2018.

This draft version of the Roadmap covers general – and partly global – aspects of leopard conservation and reviews the situation of the leopard in all African Range Countries based on readily available information. This draft Roadmap should inform the participants of the ACI Range States meeting, and prepare the discussion on leopard management and conservation. The recommendations (Chapter 3) in this draft version are reflecting the discussion between leopard experts of the IUCN SSC Cat Specialist Group and will be revised according to the discussions at the ACI Range States meeting in order to finalise this *Roadmap*.

The leopard has a wide distribution and a broad ecological niche. As a top predator, the leopard plays an important role in its ecosystems and substantially influences their structure and function. The leopard is a flagship species for conservation of prey populations and habitats, especially in the regions where it is the largest carnivore of the system.

Perhaps because of the leopard's wide distribution range and because they have demonstrated to be resilient and adaptable, they are believed to be less vulnerable to threats than other large cats. Thus, the leopard received less attention than other felids, and research and conservation projects had most often local or national scale. Large-scale conservation approaches are rare (Chapter 1.5 & 2.5). However, wherever recent surveys have been carried out, they revealed that distribution and abundance of leopards were considerably smaller than expected. Leopard populations have been highly reduced and are increasingly fragmented across its range (Jacobson et al. 2016, Stein et al. 2016; Chapter 1.2). The main threats to the leopard are habitat loss and fragmentation, prey depletion (through bushmeat poaching), and illegal killing for use and trade (Chapter 1.5).

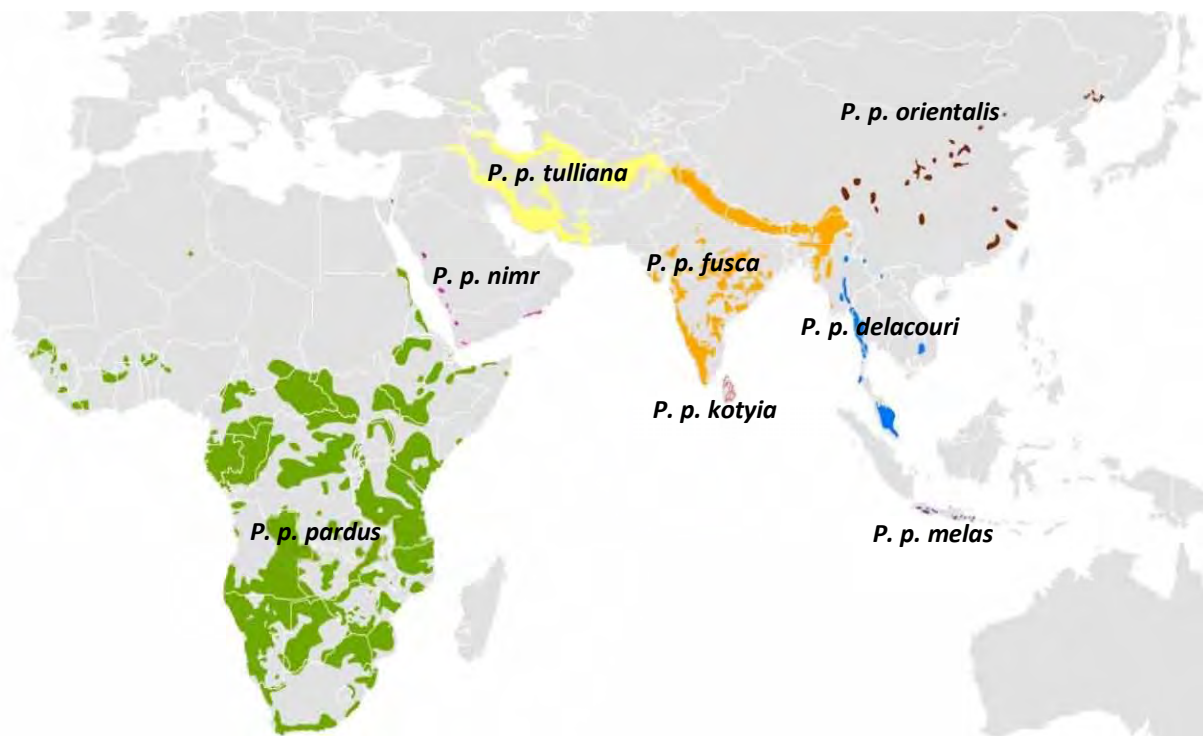
Leopard conservation is obstructed by a notorious lack of reliable information. Most leopard population size estimations and trends refer to surveys done 20–30 years ago. Up-to-date figures are available at local scale, mainly from southern Africa, and most reveal a fast declines of abundance (Chapter 2.1). Critical gaps in our understanding of leopard population trends, distribution and the impacts of threats impede a robust status assessment and consequently the development of effective conservation measures for the species. The *Roadmap for the Conservation of the Leopard in Africa* shall provide the background for the development of transboundary Regional Conservation Strategies and subsequently National Action Plans for the implementation of sensible conservation actions for the leopard in Africa under the auspice of the CMS and CITES.

## 1.1 Taxonomy

The taxonomy of the leopard was recently reviewed by the IUCN SSC Cat Specialist Group. Based on current research and an assessment of an expert task force (Kitchener et al. 2017), eight leopard subspecies are presently recognised (Fig. 1.1.1):

- *P. p. pardus* in Africa
- *P. p. nimr* in the Arabian Peninsula
- *P. p. tulliana* in Central Asia, including former *P. p. ciscaucasica* and *P. p. saxicolor*
- *P. p. melas* on the island of Java
- *P. p. fusca* in India
- *P. p. kotiya* in Sri Lanka
- *P. p. delacouri* in South-east Asia and
- *P. p. orientalis* including the Amur leopard in the Russian Far East, Korean Peninsula and north-eastern China, and the former North China leopard (*P. p. japonensis*) in northern China.

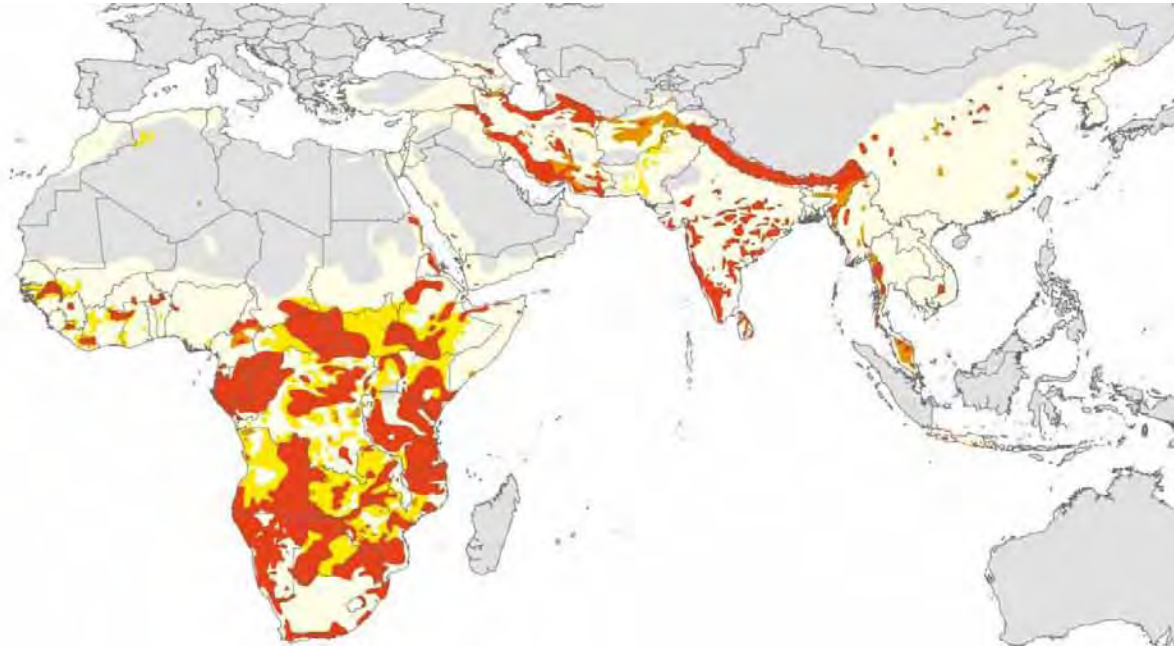
However, more comprehensive sampling is required from throughout the leopard range and more studies are needed to confirm this subspecies classification (Kitchener et al. 2017). Notably, the taxonomic status of the African subspecies *P. p. pardus* needs to be further investigated. The differences between some subspecies are high indicating adaptation to different ecological niches. For example male leopards from Iran or from eastern and southern Africa can weigh up to 90 kg, whereas Arabian leopard males reach weights of only 35 kg (Hunter & Barrett 2011, Sanei et al. 2015, Spalton & Hikmani 2014).



**Fig. 1.1.1.** Leopard distribution including extant and possibly extant range (Jacobson et al. 2016). Leopard subspecies according to Kitchener et al. (2017).

## 1.2 Distribution

The leopard has a wide distribution with an extant range of 8,510,500 km<sup>2</sup> (Jacobson et al. 2016). The species is present in 79 countries across Africa, Asia and Europe (Stein et al. 2016; Fig. 1.2). Nowadays, the leopard only occupies 25–37% of its historical range. In Africa the species has lost 48–67% and in Asia 83–87% of its historic range (Jacobson et al. 2016, Stein et al. 2016, Fig. 1.2).



**Fig. 1.2.1.** Leopard distribution. Red = extant, orange = possibly extant, dark yellow = possibly extinct, light yellow = historical, extinct (Jacobson et al. 2016).

## 1.3 Habitat, Ecology and Behaviour

### Living space

The leopard is believed to be highly adaptable but the observed versatility is also a result of “intra-specific radiation” resulting in very diverse subspecies (Chapter 1.1). The species inhabits a wide range of different ecosystems occurring in boreal forests of Russia with winter temperatures dropping below -30 C° and in deserts where summer temperatures can reach up to 70 C° (Hunter & Barrett 2011, Stein & Hayssen 2013). Leopards are found in tropical rainforests, grassland plains, temperate deciduous forests and alpine areas of high mountains. The species shows a certain tolerance for anthropogenic impacts and can also appear close to major towns such as Mumbai or Johannesburg (Jorge 2012, Stein & Hayssen 2013, Odden et al. 2014, Kuhn 2014, Jacobson et al. 2016). In Africa, the leopard lives in woodland, grassland, dry scrub, savannah and forest as well as mountain areas, coastal scrub, swampy areas, semi-desert and deserts (Stein et al. 2016). In sub-Saharan Africa the leopard has been recorded up to 5,600 m on Mt. Kilimanjaro, Tanzania (Hunter & Barrett 2011).

## Diet

Leopards are visual and ambush hunters (Sunquist & Sunquist 2002). In open habitats, they use high points such as trees to locate prey and hunt by stalking from a very low position, with long periods of time remaining motionless when necessary. The leopard is an excellent climber and prey is often dragged up into trees for eating and caching (mainly where competing carnivores are numerous; Hunter & Barrett 2011).

The leopard has a variable diet and is able to adapt to changes in prey availability. Its diet is influenced by many factors such as prey density, prey composition and by other predators, but is also affected by environmental factors and anthropogenic pressure (Balme et al. 2007, Henschel et al. 2011; Chapter 1.5 & 2.4). Leopards can kill prey up to 2 or 3 times their own weight, but they have a preference for medium sized ungulates (15–80 kg; Henschel et al. 2005, Henschel 2008, Hunter & Barrett 2011). Leopards prey on a variety of largely mammalian prey from large ungulates such as elands to small species such as rock hyraxes and arthropods (Balme et al. 2007, Hunter & Barrett 2011, Stein et al. 2016). In sub-Saharan Africa, 92 different prey species were documented. Regular leopard prey are impala, common duikers, steenbok, bushbuck, warthog, wildebeest, kudu, nyala, springbok, gazelles, reedbuck, young oryx, kob, oribi, waterbuck, blesbok, Thompson's gazelle, dikdik, aardvark, porcupine, bushpig, genets, klipspringer, hyrax, bat-eared fox, African wildcat and birds (Smithers 1971, Bertram 1982, Mizutani 1999, Hayward et al. 2006, Ott et al. 2007, Balme et al. 2010a, Hunter & Barrett 2011, Jones 2013, Stein & Hayssen 2013; Fig. 1.3.1). The leopard can live independent of surface water for periods of time, satisfying moisture requirements entirely from its prey (Spalton & Al Hikmani 2014).



**Fig. 1.3.1.** Leopard and its prey (Photo P. Meier).

## Land tenure system

Leopards are solitary (Boast 2014). They use scent or scratch marks and vocalisations to communicate and to mark territories (Stein & Hayssen 2013). Across much of their range, leopards are mainly active at night with activity peaks at dawn and dusk. However, their activity pattern can vary depending on prey availability, competing predator presence, temperature and human disturbance (Spalton & Al Hikmani 2014). In savanna and woodland areas for example, leopards are more active between sunset and sunrise, but populations in undisturbed rainforest in Gabon and in remote areas in Botswana were largely diurnal. Forest leopards seem to follow the activity patterns of their main prey species (Henschel 2008, Steinmetz et al. 2013).

**Table 1.3.1.** Examples of leopard density estimates (mature individuals/100 km<sup>2</sup>) in African Range States according to the literature.

Country	Study Area/Country	Density (adult/ 100 km <sup>2</sup> )	Reference
Botswana	Ghanzi farmland	0.1	Boast & Houser 2012
Botswana	Ghanzi region	0.48 (MMDM) 1.08 (HMMDM)	Kent 2011
Botswana	Northern Tuli Game Reserve	7.5	Shashe Limpopo group 2010
Botswana	Central Kalahari Game Reserve	0.4	CARACAL no date
Botswana	Kgalagadi Transfrontier Park	1.9–3.0	CARACAL no date
Botswana	Okavango Delta, Kwando area	1.5	CARACAL no date
Botswana	Okavango Delta, Moremi area	3.2	CARACAL no date
Cameroon	Bénoué Complex (Bénoué NP, Bobandjida NP and Faro NP) and hunting zones	1.28–1.46	Croes et al. 2011
Gabon	Lope and Ivindo NPs	2.7–12.1	Henschel 2008
Ghana	Mole NP	2–2.9	Brashares & Sam 2005
Ivory Coast	Taï NP	7–11	Jenny 1996
Kenya	Mpala ranch	8.4–12	O'Brien & Kinnaird 2011
Mozambique	Niassa National Reserve (NR)	2.18–12.65	Jorge 2012
Mozambique	Xonghile GR	1.53	Strampelli 2015
Namibia	Waterberg plateau farmland	3.6 farmland	Stein et al. 2011
	Waterberg Plateau Park	1.0 park	
Namibia	Bwabwata NP	1.18 and 2.4	Funston et al. 2014
Namibia		1.2–3.1	Stein et al. 2012
Namibia	Kalahari, tree–savannah	0.19	Kent 2011
Namibia	Kalahari, dune–savannah	0.6	Kent 2011
Sengal	Niokolo Koba NP	2.0–4.0	Kane et al. 2015
South Africa	Phinda–Mkhuze Complex	2.5–11.1	Balme et al. 2010a,b
South Africa	Kruger NP	12.7	Maputla et al. 2013
South Africa	Soutpansberg mountains	10.7	Chase Grey et al. 2013
South Africa	Soutpansberg mountains	3.65	Williams et al. 2017
South Africa	Cederberg mountains	0.25–2.3	Martins 2010
South Africa	Karongwe private game reserve	18.8	Owen et al. 2010
South Africa	Northern Kwazulu–Natal	12.7	Maputla et al. 2013
South Africa	Zululand Rhino Reserve	2.5–7.0	Chapman & Balme 2010
Tanzania	Tarangire NP	7.9	Msuha 2009
Zambia	Luambe NP and Game Management Area GMA Chanjuzi	3.36 (NP only), 4.79	Ray 2011
Zimbabwe	Savé Valley Conservancy	7.6	Williams et al. 2016
Zimbabwe	Northeastern part of Hwange NP	1.46	Loveridge et al. 2017
Zimbabwe	Mangwe district,	1–7	Grant 2012
Zimbabwe	Gonarezhou NP	8.3	Groom & Brand 2011

Home range sizes of leopards are determined by resource availability, presence of other carnivores, intra-specific density and human pressures. Thus, the size of leopard home ranges is highly variable ranging from 5.6 km<sup>2</sup> (female in Kenya's Tsavo National Park) to 2,750 km<sup>2</sup> (male in the Kalahari), and they can be transboundary in border regions (Hunter & Barrett 2011, CMS & UNEP 2017). In woodland, savannah and rainforest areas mean home ranges for females are 9–27 km<sup>2</sup> and 52–136 km<sup>2</sup> for males. In arid habitats, home ranges are larger, reaching 188–2,750 km<sup>2</sup> (Hunter & Barrett 2011). Leopards are polygynous and male home ranges generally overlap with those of several females (Caro & Riggio 2014).

Leopard density in Africa varies widely, from 0.1–12 individuals per 100 km<sup>2</sup> (Table 1.3.1). This large density variation can be attributed to the habitat type, prey density, presence of sympatric carnivores and persecution by humans.

The sex-ratio of leopards in Namibia was estimated to be almost 1:1 (Hanssen & Stander 2004). The mean adult male to adult female sex ratio in the Soutpansberg Mountains, South Africa was estimated at 1:1.65 (Williams et al. 2017).

## Reproduction and recruitment

In South Africa, leopards can reproduce throughout the year but in some areas of southern Africa, birthing peaks may coincide with the birth season of the leopard's main prey species (Stein & Hayssen 2013). Oestrus lasts about 7–14 days, the oestrus cycle for around 46 days and gestation for 90–106 days (Hunter & Barrett 2011, Sunquist & Sunquist 2002). In Angola, mating took place during the rainy season and in the Democratic Republic of the Congo at the beginning of the rainy and of the dry season (Stein & Hayssen 2013). Females reproduce for the first time with 30–36 months and males with 42–48 months. A 16-year old female was recorded giving birth in the Sabi Sand Game Reserve (South Africa). The inter-birth interval averages 16–25 months. Litter size is 1–4 cubs (Hunter & Barrett 2011, Balme et al. 2012a, Stein & Hayssen 2013). Cub mortality is quite high and varies in the first year between 50% and 90% (Balme et al. 2012a). Leopards reach independence at 12–18 months (Sunquist & Sunquist 2002). Subadult male leopards (2–4 years) are mandatory dispersers and can cover distances over 200 km, while subadult females settle more often close to their parental home ranges. One subadult male collared in Phinda game reserve (South Africa) traversed three countries and covered a distance of over 352.8 km (Fattebert et al. 2013). Subadult dispersal, including transboundary movements, is crucial for maintaining the genetic and demographic integrity of the entire (meta-) population (CMS & UNEP 2017). Dispersal is not only important for the genetic fitness of a metapopulation or for an anthropogenically fragmented population, but also an important mechanism for recolonisation of lost areas. Such recolonisation also across international borders is a conservation priority for many subspecies or regional metapopulations such as the whole of West Africa (CMS & UNEP 2017). The free migration of leopards across international borders is a crucial factor for the recovery of most endangered subspecies and populations (CMS & UNEP 2017). As the leopard has a large number of transboundary populations across its global range and enhancing international cooperation would benefit its conservation, it was listed under CMS Appendix II in 2017 (Anderson 2017; Chapter 2.1).

## 1.4 IUCN Red List Assessment of the leopard

The leopard has a very wide geographical range with several distinct subspecies and is therefore difficult to assess as a single species at global scale. Moreover, knowledge of the leopard's status is still extremely limited at regional and national scales and surveys – if available – were done under diverging approaches and at different periods. A global assessment accordingly incorporates often information over several decades. Only few reliable data on leopard population trends are available and no recent population estimate over its whole range exists. The characteristic elusiveness of leopards makes them difficult to survey. Nevertheless, modern monitoring methods, especially camera trapping, have recently shed light on the fast declines of some leopard populations in Africa and Asia. The current range-wide population trend is assessed to be decreasing (Stein et al. 2016; Chapter 2.2). Based on high inferred and suspected levels of leopard population declines of over 30% over large parts of its range in the last three generations, the leopard was globally up-listed from Near Threatened (2008) to Vulnerable in 2016 under Criteria A2cd in the IUCN Red List of Threatened Species™ (Henschel et al. 2008, Stein et al. 2016). The population decline is based on habitat loss, prey decrease and actual and potential levels of exploitation. The negative trend is thought to go on in the future unless appropriate conservation measures are taken (Stein et al. 2016). The leopard is considered possibly extinct in The Gambia, Israel, Korea, Lao PDR, Lesotho, Tajikistan and Vietnam and as regionally extinct in Hong Kong, Jordan, Korea, Kuwait, Lebanon, Mauritania, Morocco, Singapore, Syria, Togo, Tunisia, United Arab Emirates and Uzbekistan (Stein et al. 2016; Chapter 2.2).

The leopard is legally protected almost across its range. There is no legal protection in Gambia. *Panthera pardus* has been listed on Appendix I of CITES since 1975 restricting the trade of its skins or products, included under Appendix II (strictly protected species) of the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats), protected under the U.S. Endangered Species Act 16 United States Code, Section 1538 (Stein et al. 2016) and included in Appendix II of CMS since 2017 (CMS & UNEP 2017; Chapter 2.5). About 17% of the leopard's global distribution range is estimated to be protected (Jacobson et al. 2016).

All subspecies assessed in 2008 were either classified as Critically Endangered or Endangered due to small, declining and fragmented populations (Stein et al. 2016; Table 1.4.1). Re-assessment of the leopard subspecies according to the revised taxonomy of Kitchener et al. (2017) is currently ongoing.

**Table 1.4.1.** IUCN Red List assessment of leopard subspecies in 2008.

<b>Subspecies</b>	<b>Red List status 2008</b>
<i>P. p. melas</i>	Critically Endangered
<i>P. p. nimr</i>	Critically Endangered
<i>P. p. kotiya</i>	Endangered
<i>P. p. orientalis</i>	Critically Endangered
<i>P. p. saxicolor</i>	Endangered

## 1.5 Threats and Conservation Challenges

The major threats to leopards are anthropogenic in origin. Leopard populations have been reduced throughout most of their global range with drastic reductions mainly across West and Central Africa as well as throughout South-west and South-east Asia (P. Henschel, pers. comm., Stein et al. 2016). Main threats are habitat loss and fragmentation, prey base reduction, unsustainable trophy hunting, persecution due to conflicts with humans (mainly retaliation killing due to livestock and game depletion) and poaching for the wildlife trade and incidental snaring (Balme et al. 2009, 2013, Boast 2014, Daly et al. 2005, Ray et al. 2005, Hunter & Barrett 2011, Packer et al. 2011, Caro & Riggio 2014, Constant 2014, Strampelli 2015, Stein et al. 2016; Chapter 2.4).

Development projects not only impact the leopard due to habitat loss and fragmentation, but have also negative consequences for its prey, especially wild ungulate populations (Stein et al. 2016). Prey depletion, due to overhunting and overgrazing by livestock, is a major threat to leopards in many regions across its range and can be an important driver of leopard population declines (Al Jumaily et al. 2006, Henschel 2008, Judas et al. 2006, Pitman 2012, Stein et al. 2016). Human-leopard conflicts due to leopard predation on livestock (as a consequence of wild prey reduction) resulting in retaliation killing are widespread across the leopard's range. Retaliation killing due to leopard predation on game animals is a major problem only in southern Africa (G. Balme, pers. comm.). Leopards are also poached for wildlife trade as their skins are still popular and their bones are used as substitutes for tiger parts in Traditional Chinese Medicine (Hunter & Barrett 2011, Raza et al. 2012, EIA 2018). Generally, the persecution of leopard by humans threatens the survival of leopard populations (Swanepoel et al. 2014, 2015). Leopard trophy hunting is only an issue in East, Central and southern Africa, but can negatively affect leopard populations if not managed in a sustainable way (Chapter 2.4).

The main challenges for implementing leopard conservation activities and management measures include (1) lack of awareness of the critical situation for the species and its importance, (2) lack of law enforcement and implementation of protection measures, and (3) lack of capacity (including financial means) on multiple levels. An important share of the global leopard's range lays outside protected areas, even in conflict zones with limited access. However, the relative importance of the different direct and indirect threats, such as poaching for the wildlife trade, retaliation killing and bushmeat hunting on the local populations are not yet understood and require more investigation (Chapter 2.6).

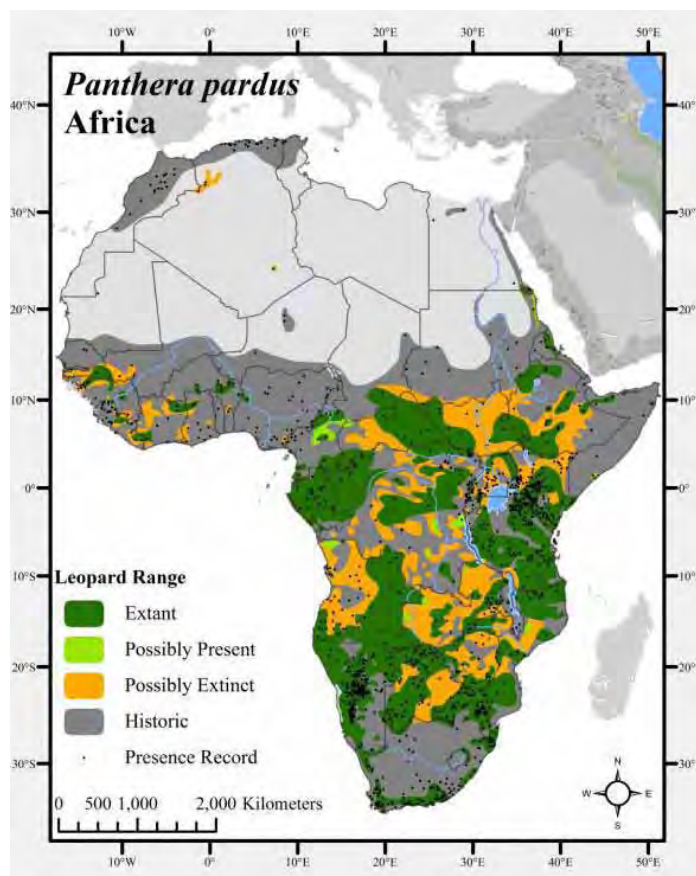


## 2. Conservation status of the leopard in Africa

The conservation status of the leopard in Africa is difficult to assess as robust monitoring data are missing from many Range States. However, recent local surveys suggest that the leopard is not doing well, not even in southern Africa, its former stronghold.

### 2.1 Distribution, status and conservation units

The historic distribution of the leopard included all of Sub-Saharan Africa, except the skeleton coast of Namibia (Jacobson et al. 2016; Fig. 2.1.1). Leopards have vanished from 48–67% of their historic range across Africa (Jacobson et al. 2016). The range loss was most prominent in the northern (Sahara and Sahel zone) and southern (South Africa) parts of the continent. The current distribution of the leopard across Africa is not fully understood but the species still seems to be present in many areas of Africa (Fig. 2.1.1) but to have an increasingly fragmented distribution (Boast 2014, Jacobson et al. 2016, Stein et al. 2016). As the local population status (e.g. abundance, trend, reproductive status) is not known in most cases, it is possible that the status of the leopard is critical – especially outside protected or specially managed areas – and that the species may disappear over large areas of its distribution range in the near future.



**Fig. 2.1.1.** Current leopard distribution in Africa according to Jacobson et al. (2016). The distribution range is divided according to IUCN guidelines, into extant, possibly extant (corresponding to possibly present in Jacobson et al. (2016)), possibly extinct and extinct (corresponding to historic in Jacobson et al. (2016)).

## Transboundary (meta) populations

Many important leopard populations are transboundary and have the form of metapopulations. Individuals are cyclically and predictably crossing one or more national jurisdictional boundaries (population identification and names according to Jacobson et al. 2016; CMS & UNEP 2017; Table 2.1.1), and dispersing subadult animals, which are important for maintaining the demographic and genetic integrity of the populations, need to be able to cross international borders.

**Table 2.1.1.** Transboundary leopard (meta) population, countries sharing the transboundary leopard populations and patch name(s) according to Jacobson et al. (2016).

<b>Countries</b>	<b>Patch names</b>
Guinea/Guinea-Bissau/Mali/Senegal	Nikolo Koba and Guinea
Liberia/Sierra Leone	Foya, Gola and forests, northern Liberia
Ivory Coast/Liberia	Tai forest
Burkina Faso/Ivory Coast/Ghana	Comoe and Mole
Ghana/Burkina Faso	northern Ghana and southern Burkina Faso; Kabore-Tambi
Benin/Burkina Faso/Niger	W-Arly-Pendjari
Benin/Nigeria	Kainji and Trois Rivières
Cameroon/Nigeria/Chad	Benoue ecosystem
Cameroon/Equatorial Guinea	Camp Ma'an
Angola/CAR/Cameroon/DRC/Congo/Gabon/Equatorial Guinea	West Congo Basin
CAR/DRC/Sudan/South Sudan/Chad	Eastern Central African Republic
Egypt/Sudan	Red Sea coast
Ethiopia/Sudan	northern Ethiopia
Djibouti/Eritrea/Ethiopia	Mousa Ali Mountains
Ethiopia/Kenya/ South Sudan	Boma-Gambella, southern Ethiopia
Ethiopia/Somalia	Gaan Libaax and eastern Ethiopia
Kenya/South Sudan/Uganda	northern and eastern Uganda
DRC/Uganda	greater Virunga
Rwanda/Tanzania/Uganda	Akagera, Rumanyika and Lake Mburo
Burundi/Rwanda	Nyungwe
Kenya/Mozambique/Somalia/Tanzania	Kenya,Tanzania, northern Mozambique
Angola/Botswana/DRC/Mozambique/Malawi/Namibia/South Africa/Zambia/Zimbabwe	central Southern Africa & coastal Namib
Mozambique/Zimbabwe	Marromeu and central Mozambique
Botswana/Zimbabwe	Matopos and south western Zimbabwe
Botswana/Mozambique/South Africa/Eswatini (Swaziland)/Zimbabwe	Kruger and eastern Southern Africa
Lesotho/South Africa	Drakensberg Mountains

## Conservation units

Given the wide range of the leopard in Africa and the regional differences of its status, it is not possible to integrate all countries under one leopard conservation plan, although many strategic goals might be valid for the whole of the continent if not for the species' global range. The division of the leopard range into "conservation units" allows developing more specific and effective Regional Conservation Strategies (and subsequently National Action Plans), also in order to facilitate transboundary cooperation between Range Countries. Each unit would be managed as one entity but be informed by an over-arching leopard conservation framework (e.g. this *Roadmap*; see also Chapter 3.3). The delineation of meaningful and practical conservation units should consider:

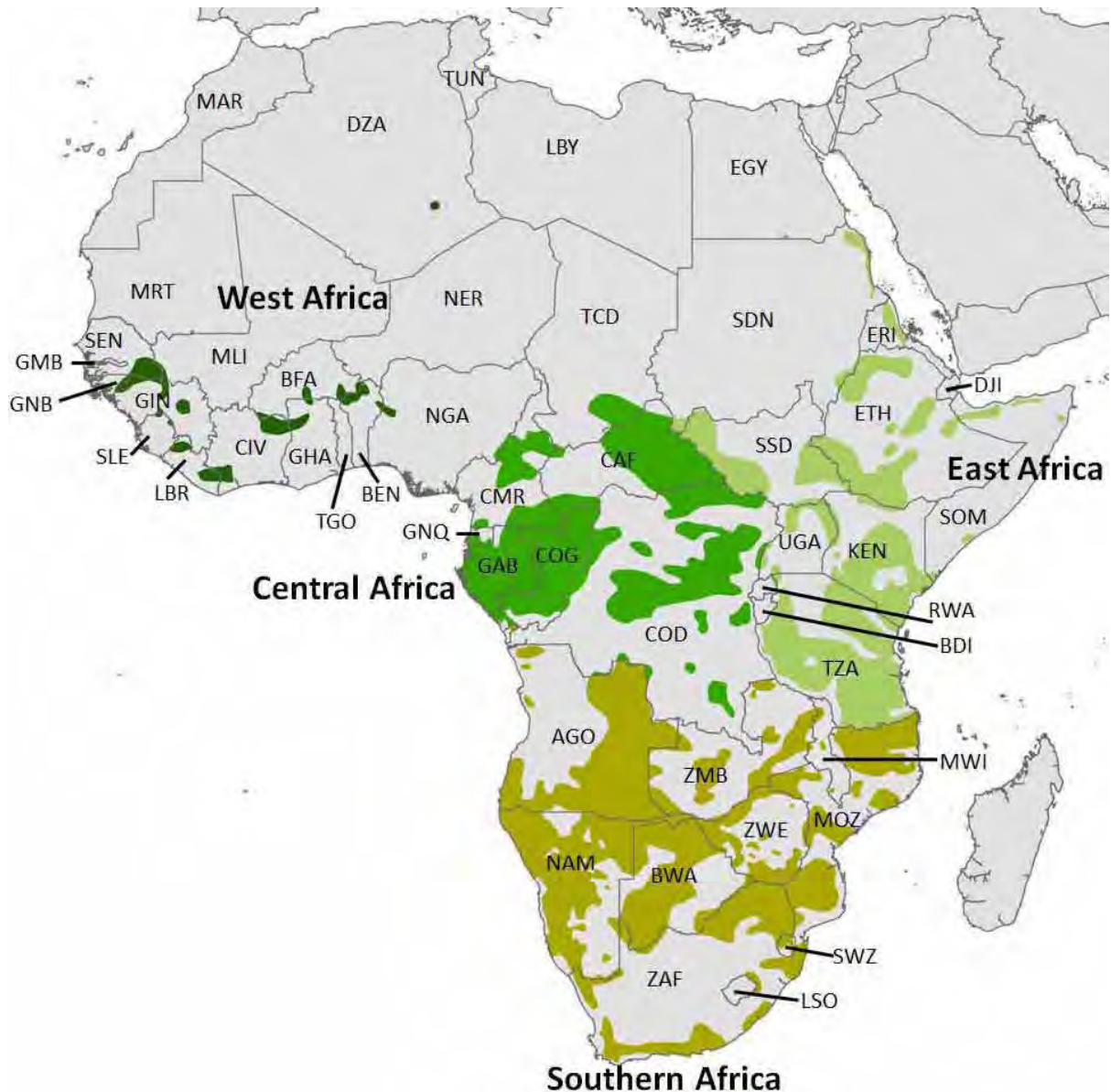
- The leopard subspecies classification as proposed by Kitchener et al. (2017), assuming that subspecies should be conserved as phylogenetic entities;
- For subspecies with a very wide distribution (e.g. *P. p. pardus* across Africa) according to phylogenetic and ecological features ("ecotypes") and the most current global distribution map (metapopulations);
- Existing conservation strategies and ongoing conservation efforts and management practices;
- Shared cultural (e.g. language) and geographic factors; and prevailing relationships between countries (e.g. existing conservation agreements).

For Africa, we propose four regional conservation units: West Africa, Central Africa, Southern Africa and East Africa (Table 2.2, Fig. 2.1.2).

**Table 2.2.1.** Proposed conservation units for Africa and countries included in each conservation unit.

Conservation unit	Countries included
West Africa	Algeria, Benin, Burkina Faso, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo
Central Africa	Cameroon, Central African Republic, Chad, Republic of the Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Nigeria
Southern Africa	Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Eswatini (Swaziland), Zambia, Zimbabwe
East Africa	Burundi, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Sudan, Rwanda, Somalia, South Sudan, Tanzania, Uganda

The division into four conservation units is for practical reasons. Each conservation unit consists of geographically different challenges and has different characteristics with regard to wildlife and conservation priorities (European Commission 2014). Manageable numbers of countries having a common language have been combined into one unit, based on regions as used e.g. also by the European Commission (2014) and following the example of conservation units defined for the wild dog and cheetah. As the leopard is almost extinct in northern Africa (extant range: 5,800 km<sup>2</sup>, 94–99% of historical range lost; Jacobson et al. 2016), countries such as Algeria or Egypt, where some leopards may still exist, are included in the conservation units West and East Africa, respectively (Fig. 2.1.2). However, the recovery of the leopard in Saharan Africa will require very special efforts.



**Fig. 2.1.2.** Proposed conservation units for Africa. Extant and possibly extant leopard range (Jacobson et al. 2016; Fig. 2.1.1) combined.

## 2.2 Leopard population status, estimations and trends per conservation unit

The last Africa-wide leopard population estimate dates back to a model from 1988, developed by Martin & de Meulenaer (1988), who estimated 714,000 leopards across the whole of Africa. However, this estimate was subsequently challenged by several researchers to be too simplistic and a high overestimation (Jackson 1989, Norton 1990, Jenny 1996, Nowell & Jackson 1996, Henschel 2008, Balme et al. 2010b). In fact, *“few reliable data on changes in the leopard status throughout Africa exists although there is compelling evidence that subpopulations have likely declined considerably”* (Stein et al. 2016).

Numbers of sub-Saharan leopards are declining within large portions of their range, particularly outside of PAs (Stein et al. 2016). Widespread habitat loss (21% in sub-Saharan Africa in 25 years) and prey loss inside PAs (59% decline) is likely to have caused leopard declines of over 30% over the last

three generation (22.3 years). Thus, the leopard subpopulations across Sub-Saharan Africa potentially qualify as Vulnerable (Stein et al. 2016).

In North Africa the leopard is proposed as Critically Endangered, based on very small and declining numbers of mature individuals. The leopard is extinct in Tunisia and Morocco, there are possibly no remaining populations in Algeria and the population in Egypt is considered to be very small (Stein et al. 2016).

In the following, we summarise the population status, abundance and trends including legislation and management of the leopard per conservation unit, based on readily available information. For many countries, such information is limited and we found no up-to date information on the status, abundance and trend. To describe the leopard's current distribution, we use the patch names given by Jacobson et al. (2016), and indicate them in *italics*. Information for the status of the leopard in the different conservation units is retrieved from Jacobson et al. (2016) and Stein et al. (2016) if not referenced differentially. Jacobson et al. (2016) provide in their supplement documentation ([Profiles of Leopard \(\*Panthera pardus\*\) Range Countries](#)) detailed information on the status of the leopard per country. Reliable surveys or at least consistent compilation of available information in all African leopard Range States in order to make a more reliable assessment based on IUCN Red List procedures is essential.

In Morocco the leopard is considered extinct (Stein et al. 2016). However, a possible leopard record was reported near Figuig in 2007 close to the Morocco-Algeria border and until the 2000s leopards were reported around Bou Tferda, Atlas Mountains (Jacobson et al. 2016). Morocco is a Party to CITES and CMS (CITES 2018a, CMS 2018).

In Mauritania and Tunisia the leopard is extinct (Stein et al. 2016).

## West Africa

The extant range of the leopard in West Africa was estimated at 196,000 km<sup>2</sup>. The leopard has become very rare throughout West Africa mainly due to a lack of prey (i.e. due to bushmeat trade) and retaliation killing due to livestock predation. The species lost 86–95% of its historic range in West Africa. It has completely disappeared from parts of the Western Sahel and from most of the West African coastal belt. Leopards are now restricted to a few PAs from Senegal (confirmed records in Niokola-Koba NP) in the west to western Nigeria in the east. It is unlikely that resident leopard populations exist outside PAs. Leopards still persist at low densities in W-Arly-Pendjari Complex (WAP), a network of PAs expanding through Burkina Faso, Benin and Niger, but are largely absent from these countries outside the WAP complex. Leopards are considered extant in Senegal, Guinea, Guinea-Bissau, Sierra Leone, Liberia, Ivory Coast, Mali, Burkina Faso, Ghana, Benin, Niger and Nigeria, possibly extinct in The Gambia and extinct in Mauritania and Togo. Its presence in Algeria is uncertain.

### *Algeria*

The presence of the leopard in Algeria is uncertain (Stein et al. 2016). The last leopard record – a genetically identified scat sample – is from the Ahaggar Massif in 2005, but more survey is needed to confirm the presence of the species. The leopard may also persist in the western Saharan Atlas Mountains extending into Morocco. An unconfirmed report comes from near Figuig, Morocco (Jacobson et al. 2016). The possibly extant leopard range was estimated at 3,600 km<sup>2</sup> (Jacobson et al. 2016).

Algeria is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Benin*

Leopards are extant but rare (Stein et al. 2016). The species persists in the WAP complex in the Pendjari NP. Outside these areas little information is available and the leopard is assumedly absent from large areas. It possibly still occurs in the forests surrounding Monts Kouffé (Jacobson et al. 2016).

The extant leopard range was estimated at 16,300 km<sup>2</sup> with PAs covering 5,047 km<sup>2</sup> (31%) of extant leopard range (Jacobson et al. 2016).

Benin is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Burkina Faso*

Leopards are extant but largely absent from the country (Stein et al. 2016). Leopards were recorded in and around the WAP complex, in the PONASI (Pô-Nazinga-Sissili) complex and the Comoé-Léraba community managed area next to the Ivory Coast's Comoé NP (Jacobson et al. 2016). The extant leopard range was estimated at 19,000 km<sup>2</sup> with PAs covering 8,550 km<sup>2</sup> (45%) of extant leopard range (Jacobson et al. 2016).

Burkina Faso is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *The Gambia*

The leopard is considered as possibly extinct (Stein et al. 2016). There are possibly only small fragmented populations remaining. A leopard was sighted in Kiang West NP in 2000 and tracks found in Niimi NP in 2001. The latter was however possibly a migrant from Saloum Delta NP in Senegal. Leopards possibly occur in the Kiang West and Bao Bolon NP (Jacobson et al. 2016).

The Gambia is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Ghana*

The leopard is extant but absent from large parts of the country (Stein et al. 2016). Leopards were confirmed in Mole NP and unconfirmed reports come from Bia Conservation Area and the Kakum NP (Jacobson et al. 2016). The extant leopard range was estimated at 14,700 km<sup>2</sup> with PAs covering 4,115 km<sup>2</sup> (28%) of extant leopard range (Jacobson et al. 2016).

Ghana is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Guinea*

The leopard is extant but absent from large parts of the country (Stein et al. 2016). The population is believed to be declining. Leopards were recorded in the Foutah Djallon area, Guinean highlands and the Upper Niger NP. In the latter, likely only a very small population persists (Jacobson et al. 2016). The extant leopard range was estimated at 28,700 km<sup>2</sup> with PAs covering 891 km<sup>2</sup> (3.1%) of extant leopard range (Jacobson et al. 2016).

Guinea is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Guinea-Bissau*

The leopard is extant but rare in various areas (Stein et al. 2016). Leopards were recorded in the south and east, "between the Geba river, along the coast and near the borders with Guinea and Senegal, and also in a few areas to the west of the Geba river, along the coast and near the border with

*the Casamance region, Senegal*" (Jacobson et al. 2016). Leopards were confirmed in the Boé PA (Jacobson et al. 2016). The extant leopard range was estimated at 7,000 km<sup>2</sup> (Jacobson et al. 2016).

Guinea-Bissau is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Liberia*

The leopard is extant (Stein et al. 2016). Leopards might still occur in the southeast (Sapo NP, confirmed in 2007–2009) and northwest (Gola Forest) of the country. They were recorded in North Lorma and Grebo National Forests. Leopards might cross into Liberia from Gola NP, Sierra Leone (Jacobson et al. 2016). The extant leopard range was estimated at 23,000 km<sup>2</sup> with PAs covering 984 km<sup>2</sup> (4.3%) of extant leopard range (Jacobson et al. 2016).

Liberia is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Mali*

The leopard is extant but considered to be "near extinct". The species possibly only persists in the Guinean ecoregion of southwest Mali (Jacobson et al. 2016). The extant leopard range in Mali was estimated at 6,000 km<sup>2</sup> (Jacobson et al. 2016).

Mali is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Niger*

The leopard is extant but nearly extinct in the country (Stein et al. 2016, Jacobson et al. 2016). Leopard presence is only confirmed in the WAP complex, in the W National Park in the southwest but seems to occur in very low numbers (Jacobson et al. 2016). The extant leopard range was estimated at 500 km<sup>2</sup> with PAs covering 497 km<sup>2</sup> (99.5%) of the extant leopard range (Jacobson et al. 2016).

Niger is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Nigeria*

The leopard is extant in Nigeria (Stein et al. 2016). The species was confirmed in several PAs in the east and south. It was reported from Okomu NP, Okomu Forest Reserve, Weppa Farms, Gashaka-Gumti NP and Kainji Lake NP (Ikemeh 2007, Jacobson et al. 2016). Its occurrence in Cross River NP is doubtful (Jacobson et al. 2016). The extant leopard range was estimated at 11,500 km<sup>2</sup> with PAs covering 7,860 km<sup>2</sup> (68.4%) of the extant leopard range (Jacobson et al. 2016).

Nigeria is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Senegal*

The leopard is extant but largely absent from the country (Stein et al. 2016). The species occurs in the Niokola-Koba NP and possibly still exists in the Delta du Saloum NP (Jacobson et al. 2016). The extant leopard range was estimated at 29,400 km<sup>2</sup> with PAs covering 7,415 km<sup>2</sup> (25.2%) of extant leopard range (Jacobson et al. 2016).

Senegal is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Sierra Leone*

The leopard is extant but occurs only in few small parts of the country (Stein et al. 2016). The species was confirmed in Gola Forest Reserve in 2005–2007 (Jacobson et al. 2016). The extant leopard range was estimated at 500 km<sup>2</sup> with PAs covering 315 km<sup>2</sup> (63%) of extant leopard range (Jacobson et al. 2016).

Sierra Leone is a Party to CITES (CITES 2018a).

### *Togo*

Leopard is extinct (Stein et al. 2016).

## Central Africa

The extant leopard range in Central Africa was estimated at 2,081,900 km<sup>2</sup>. Leopards are still widely distributed across Central Africa but with large expanses where the species is absent or unconfirmed. The species has lost 45–66% of its historic range across Central Africa. Leopard range was highly reduced in areas of increased human influence and easily accessible areas prone to illegal hunting and bushmeat trade. Close to human areas, large wildlife species are virtually gone due to heavy hunting pressure (P. Henschel, pers. comm.). Leopards are however considered extant in all countries in this conservation unit (Cameroon, Central African Republic, Chad, Republic of the Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Nigeria).

### *Cameroon*

The leopard is extant, but its distribution is reduced and fragmented (Stein et al. 2016). Leopards are distributed in the south-east and in a few PAs across the country (Jacobson et al. 2016). Leopards are mainly found in the Bénoué Complex and occur in Campo Ma'an, Dja, Mbam et Djerem, Lobeke and Boumba Bek Nki (Henschel 2008, 2009). The extant leopard range was estimated at 132,700 km<sup>2</sup> with PAs covering 29,122 km<sup>2</sup> (21.9%) of extant leopard range (Jacobson et al. 2016).

Cameroon is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Central African Republic*

The leopard is extant and could occur in up to 85% of the country (Jacobson et al. 2016, Stein et al. 2016). Leopards may still exist in the northwest close to the border with Cameroon and Chad. They were recorded in Dzanga-Sangha NP, in Ngotto Forest, in the Chinko area, the Zemongo Faunal Reserve and south of Bangassou Forest in the south and centre of the Central African Republic (Jacobson et al. 2016). The extant leopard range was estimated at 369,200 km<sup>2</sup> with PAs covering 70,871 km<sup>2</sup> (19.2%) of extant leopard range (Jacobson et al. 2016).

The Central African Republic is a Party to CITES (CITES 2018a).

### *Chad*

The leopard is extant but its presence and status are largely unknown. Leopards are confirmed in Zakouma NP (Jacobson et al. 2016, Stein et al. 2016). The extant leopard range was estimated at 68,700 km<sup>2</sup> with PAs covering 27,021 km<sup>2</sup> (39.3%) of extant leopard range (Jacobson et al. 2016).

Chad is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Republic of the Congo*

The leopard is extant and likely still widely distributed (Jacobson et al. 2016, Stein et al. 2016). The leopard is considered extant throughout the *West Congo basin* including the vast majority of the Republic of the Congo with the exception of areas of *scattered Congo Basin tropical forest* in the south along the border to Democratic Republic of the Congo, where it is currently considered extinct. Leopards were reported from Odzala-Kokoua NP and may still be present in different PAs such as



Nouabale-Ndoki NP, proposed Ogooué-Leketi NP, Lesio-Louna Reserve and Conkouati-Douli (Jacobson et al. 2016). The extant leopard range was estimated at 310,000 km<sup>2</sup> with PAs covering 36,366 km<sup>2</sup> (11.7%) of extant leopard range (Jacobson et al. 2016).

The leopard population in the country was assessed as “satisfactory” and as “secure” in the rainforests of the northern Congo (Henschel 2008). However, leopards were recently not often recorded in Odzala-Kokoua NP in the northwest as compared to the neighbouring country Gabon (Henschel et al. 2014).

The Republic of the Congo is a Party to CITES and CMS (CITES 2018a, CMS 2018). The leopard is listed as fully protected species (Obank et al. 2015). The principal wildlife legislation in the country is the Wildlife and Protected Areas Act of 2008. It contains penalties for importing, exporting, detaining or carrying for transit certain species or trophies. The Fully and Partially Protected Species Order of 2011 states that fully protected species, such as the leopard, are not allowed to be captured, transported, sold, killed, imported or exported for non-scientific purposes (Obank et al. 2015). The Wildlife and Protected Areas Agency Act of 2012 “created a new regulatory agency dedicated to wildlife and protected areas” (Obank et al. 2015). PAs are managed by guards and cannot be used. Hunting, capturing, slaughtering or exporting protected wildlife is prohibited if not authorised by the Ministers responsible for the environment and forestry (Obank et al. 2015). Different categories of hunting permits exist. Hunting licenses can be issued for sport, scientific purposes, detention, subsistence hunting or collection. Rural people are allowed to hunt for subsistence purposes within their territories. However, the killing of fully protected (incl. leopard) or partially protected wild animals must be reported to local authorities (Obank et al. 2015).

### *Democratic Republic of the Congo*

Leopards are extant and likely still widespread (Jacobson et al. 2016, Stein et al. 2016). Leopards were confirmed in Virunga NP, in Camp Louis-Gangu forest/savannah mosaic in 2004, in Camp Louis and Gangu forest in 2007 in the forests of Bili, Nambala, Bakalakala and Gbangadi in 2006, in Zongia forest in 2007, and in the forests of Mbange, Bambesa and Ngume in 2008 (Hicks 2010). Leopards were reported in Garamba NP, Salonga NP in 2004, in Upemba NP in 2008, in Kundelungu NP, in Tshuapa-Lomami-Lualaba Conservation Landscape (TL2), in Mangai NR, Okapi WR, Bili Uere, in Lomako-Yokokala NR and Kahuzi-Biéga NP (van Krunkelsven et al. 2000, Hart 2009, UICN/PACO 2010). Leopards were considered to be abundant in the forests of Camp Louis, Gangu, Gbangadi, Ngume and Bongenge, and to be present in Bili and Bili South, Zongia, Mbange East, Lebo and Malembobi (Hicks 2010). Leopard evidence was detected in the Ituri forest, Bili-Uere, Salonga NP and TL2 (Jacobson et al. 2016).

Leopards are considered extinct or possibly extinct in large parts of the country but to remain extant in a large patch in *Central DRC*, in *Lomako-Yokokala*, *Upemba* and *Kundelungu*, and in the trans-boundary areas of the *West Congo basin* in the west, *Eastern CAR* in the North, *greater Virunga* along the border with Uganda, and in small areas of *central Southern Africa* along the border with Angola. Leopards are possibly extant in *west central Kataanga province*, *south-west Maniema province* and in *Itombwe* and *Luama-Kivu* (Jacobson et al. 2016). The extant leopard range was estimated at 657,600 km<sup>2</sup> with PAs covering 102,879 km<sup>2</sup> (15.6%) of the extant leopard range (Jacobson et al. 2016).

The leopard was listed as threatened in the Democratic Republic of the Congo (Eba’a Atyi & Bayol 2009).

The Democratic Republic of the Congo is a party to CITES and CMS (CITES 2018a, CMS 2018). Exploitation of wildlife is only allowed with authorisation if the Congolese Institute for the Conservation of Nature certifies that the off-take will not be detrimental. To export (parts of) a protected animal, a Legitimate Detention Certificate is needed, together with payment of associated taxes. For ordinary hunting a species, a permit must be obtained (Herschman et al. 2014). According to Herschman et al. (2014), “*hunting permits may be granted pursuant to the Hunting Law for sport, tourism, rural hunting (subsistence hunting), commercial purposes, scientific purposes, and administrative purposes, and the State Commissioner may permit certain persons the right to hunt protected animals in protected areas for scientific purposes*”.

### *Equatorial Guinea*

The leopard is extant but absent from almost half of the country (Stein et al. 2016, Henschel 2008). The species likely is restricted to a small population at Monte Alén NP and to the edges of the country (Henschel 2008). The extant leopard range was estimated at 12,800 km<sup>2</sup> with PAs covering 2,812 km<sup>2</sup> (22%) of the extant leopard range (Jacobson et al. 2016).

Equatorial Guinea is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Gabon*

The leopard is extant and thought to be still widely distributed in and outside of PAs, occupying most PAs, except in the northern corner east of Equatorial Guinea. Gabon likely still harbours a significant leopard population (Henschel 2008, 2009, Jacobson et al. 2016, Stein et al. 2016). Leopards were confirmed in Ivindo NP and possibly present in Moukalaba-Doudou NP, Loanga NP, Birougou NP, Batéké Plateau NP, Waka NP, Lopé NP, Pongara NP, Monts de Cristal NP, Minkébé NP, Mwagné NP and Wonga-Wongué Reserve (Jacobson et al. 2016). However, leopard densities seem only to be high or medium in small parts of Gabon (Henschel 2008). The extant leopard range was estimated at 250,000 km<sup>2</sup> with PAs covering 33,218 km<sup>2</sup> (13.3%) of extant leopard range (Jacobson et al. 2016).

Gabon is a Party to CITES and CMS (CITES 2018a, CMS 2018). The leopard is listed as a completely protected species in the country (Obank et al. 2015). Legislation for the protection of wildlife and creation of conservation areas and NPs is partly administered through Gabon’s Forest Code of 2001 and National Parks Law of 2007, with the Code being the main legislation for wildlife trade in the country (Obank et al. 2015). These legislations set laws for different trafficking and poaching offences. Completely protected species cannot be captured or transported, nor may trophies be taken from them. They can only be hunted, captured or exploited with a scientific permit, but not for commercial purposes (Obank et al. 2015).

In 2008, the leopard population in Gabon was assessed as “satisfactory” and its status as “secure” in the rainforests of central and north-eastern Gabon (Henschel 2008).

### *Ivory Coast*

Leopards are extant but there is evidence that they only persist in PAs. The species was recorded in Comoé NP in 2010 and in Taï NP (Jacobson et al. 2016, Stein et al. 2016). The extant leopard range was estimated at 39,200 km<sup>2</sup> with PAs covering 16,277 km<sup>2</sup> (41.5%) of extant leopard range (Jacobson et al. 2016).

Ivory Coast is a party to CITES and CMS (CITES 2018a, CMS 2018).

## East Africa

The extant leopard range in East Africa was estimated at 1,457,200 km<sup>2</sup>. The species lost 45–60% of its historic range in East Africa. Leopard distribution has been notably reduced in Somalia, Kenya, Ethiopia and central Tanzania. Leopards are considered extant in all countries in this conservation unit (Burundi, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Somalia, South Sudan, Tanzania and Uganda).

### *Burundi*

The leopard is considered extant by Stein et al. (2016) but only “possibly extant” by Jacobson et al. (2016). Leopards may persist in *Ruvubu* NP and are possibly extinct in the transboundary area with *Nyungwe, Rwanda* (Jacobson et al. 2016). Some 1,260 km<sup>2</sup> (4.5%) of Burundi consists of NPs and NRs (ISTEEBU 2016). The possibly extant leopard range was estimated at 900 km<sup>2</sup>, of which PAs cover 494 km<sup>2</sup> (54.9%; Jacobson et al. 2016).

Burundi is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Djibouti*

The leopard is extant (Stein et al. 2016). The species is possibly still present in small isolated regions; along parts of the border with Ethiopia in the north (tri-country border with Eritrea), west (Lake Abbe) and south (tri-country border with Somalia), in the Day Forest NP ecosystem, on the coast between the town of Arta and the Gulf of Tadjoura, and south of Arta (Jacobson et al. 2016). The extant leopard range was estimated at 1'600 km<sup>2</sup> (Jacobson et al. 2016).

Djibouti is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Egypt*

The leopard is still considered extant in Egypt but there may be only a small population left (Jacobson et al. 2016, Stein et al. 2016). Only few recent records exist: two in south-eastern Egypt in 2010 and one from Elba NP (Hala'ib triangle region) in 2014. This leopard may have been a transient animal from Sudan (where, however, leopard presence is uncertain) or a very small leopard population may persist in the Gebel Elba region (Jacobson et al. 2016). The extant leopard range was estimated at 5,800 km<sup>2</sup> (Jacobson et al. 2016).

Egypt is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Eritrea*

The leopard is extant (Stein et al. 2016). The species may still persist in a few areas such as the highland forests in central and eastern Eritrea. Leopards were reported in the Mrara and Fil Fil areas of Semenawi Bahri, in Elaberdi, Debresina, Wasdama Mountain and Geleb in the Anseba region, around Hugar Mountain in the Nakfa region and along the eastern escarpment of central Asmara region. The species may still exist along the border with Ethiopia in the Gash Barka region, possibly extending into Ethiopia (Jacobson et al. 2016). The extant leopard range was estimated at 22,600 km<sup>2</sup> with PAs covering 1,743 km<sup>2</sup> (7.7%) of the extant leopard range (Jacobson et al. 2016).

Eritrea is a party to CITES and CMS (CITES 2018a, CMS 2018).

### *Ethiopia*

The leopard is extant (Stein et al. 2016). There are few leopard records from various areas across Ethiopia. During the 2009 National Lion Conservation Workshop, “several thousand” leopards were

reported. Leopards were recorded in Datil Wolel NP in 2013, in Mazie NP in 2007–2008, Babilie Elephant Sanctuary and May Anbesa (Jacobson et al. 2016). The extant leopard range was estimated at 346,900 km<sup>2</sup> with PAs covering 35,444 km<sup>2</sup> (10.2%) of the extant leopard range (Jacobson et al. 2016).

Ethiopia is a party to CITES and CMS (CITES 2018a, CMS 2018). The leopard is listed as Least Concern in the Red List of Ethiopia (Jacobson et al. 2016).

### *Kenya*

The leopard is extant (Stein et al. 2016). Leopards only inhabit southern and central Kenya, as part of a transboundary patch covering *Kenya, Tanzania and North Mozambique*. Leopards were documented in Laikipia district (Ogada et al. 2003, Romañach et al. 2007), close to Tsavo NP, (Patterson et al. 2004) in the Amboseli Ecosystem, in the Hells Gate-Mt. Longonot Ecosystem, Kiunga-Boni-Dodori Conservation Area, Meru Conservation Area, Mt. Kenya Ecosystem, Ruma NP, Chyulu Hills NP, Tsavo East NP and Tsavo West NP (Kenya Wildlife Service, no date a, b, c, d, e, f, g), in Nairobi NP and Masai Mara NR (Okello et al. 2014a, Jacobson et al. 2016). Leopards are extant in the *Kakamega forest* and in narrow strips belonging to the transboundary patches of *northern and eastern Uganda* in the west, and *Boma-Gambella & southern Ethiopia* in the north. Leopards are considered possibly extinct in the arid regions of the north and east of the country, and in *unprotected lands west of Tana river*, while they are extinct in *eastern Lake Victoria, western Lake Turkana, the western Chalbi desert, central Kenya* and the *Tana delta*. The extant leopard range was estimated at 312,900 km<sup>2</sup>, of which PAs cover 39,401 km<sup>2</sup> (12.6%; Jacobson et al. 2016).

Kenya is a Party to CITES and CMS (CITES 2018a, CMS 2018). The leopard is listed as Endangered (Republic of Kenya 2013). The 1976 Wildlife Act was the main legislation addressing wildlife conservation and protection in Kenya. It resulted in the creation of the Kenya Wildlife Service and compensation programmes for injured or killed animals (Monk et al. 2014a). On 10 January 2014, a new Wildlife Conservation and Management Act was put into force. This Act encourages public participation and local ownership of wildlife for conservation and management, aims to provide benefits from wildlife conservation to landowners and to enhance sustainable wildlife utilisation (Monk et al. 2014a). Leopard trophy hunting is prohibited in Kenya since 1977 (Republic of Kenya 2013).

### *Rwanda*

Leopard is extant but (possibly) extinct across the majority of the country (Stein et al. 2016). Leopards likely still persist in the Akagera NP, but are possibly only present in the transboundary area of *Akagera, Rumanyika and Lake Mburu* in the north-east and possibly extinct in *Nyungwe* in the south-west of the country. The extant leopard range was estimated at 2,200 km<sup>2</sup> with PAs covering 911 km<sup>2</sup> (41.4%) of extant leopard range (Jacobson et al. 2016).

Rwanda is a Party to CITES and CMS (CITES 2018a, CMS 2018).

### *Somalia*

The leopard is extant but its status is not fully clear (Stein et al. 2016). Leopards were recorded in the foothills of the coastal plains in the region between Berbera and Loyada and were sighted in the Lower Shabelle region in 2006–2008 (Jacobson et al. 2016). Leopards possibly persist in the forested escarpments of Gaan Libaax and the Dallo Forest, Somaliland and in some areas in the south (Jacobson et al. 2016). Leopards may still remain in mountainous areas (P. Henschel, pers. comm.). The extant leopard range was estimated at 33,700 km<sup>2</sup> (Jacobson et al. 2016).

Somalia is a Party to CITES and CMS (CITES 2018a).

### *South Sudan*

The leopard is extant, but possibly extinct across most of the country (Stein et al. 2016). Only in the Imatong Mountains to the border with Uganda a leopard was reported recently (Jacobson et al. 2016). The extant leopard range was estimated at 249,800 km<sup>2</sup> with PAs covering 46,848 km<sup>2</sup> (18.8%) of extant leopard range (Jacobson et al. 2016).

### *Sudan*

The leopard is extant but largely absent from the country (Stein et al. 2016). The species possibly is still present in the Dinder NP and the arid mountains along the Red Sea. In 2014, a leopard was killed in the Hala'ib triangle region, south-eastern Egypt near the Sudan border and possibly came from Sudan (Jacobson et al. 2016). The extant leopard range was estimated at 31,000 km<sup>2</sup>, of which PAs cover 7,969 km<sup>2</sup> (25.7%; Jacobson et al. 2016).

Sudan is a Party to CITES (CITES 2018a).

### *Tanzania*

The leopard is extant across the majority of the country (Jacobson et al. 2016, Stein et al. 2016). The leopard is widespread and presently occurs in all NPs with the exception of Gombe Stream NP and Rubondo Island NP, as well as in all Game Reserves and most of the larger Forest Reserves plus in unprotected landscapes (Jacobson et al. 2016, TAWIRI 2007). The species is also possibly present in Pare mountains (Jacobson et al. 2016) and commonly sighted in Selous Niasse Wildlife Corridor (Clark & Begg 2010). Leopard distribution has declined, especially in the centre of the country. The leopard is extinct in the *south and east of Lake Victoria*, around the *Usambara mountains* in the north, around *Dar es Salaam*, *west of Rungwa GR*, *east of Ruaha NP*, along the *border to Zambia and Malawi* and in *south-east coast Tanzania* and is possibly extinct in *north-west Tanzania* (except in and around *Rumanyika*), along the shores of Lake Malawi and in small area on the shore of Lake Tanganyika on the border with *Zambia* (Jacobson et al. 2016). Leopards are found in the Serengeti-Ngorongoro Crater system and to the south and west of the country but appear to be absent from the south-eastern shore of Lake Victoria to central Tanzania (Stein et al. 2016). The extant leopard range in Tanzania was estimated at 672,100 km<sup>2</sup> with PAs covering 160,595 km<sup>2</sup> (23.9%) of extant leopard range (Jacobson et al. 2016).

The leopard population was conservatively estimated at 19,673 individuals (guestimate; [Annex 4](#), CITES 2018b).

Tanzania is a Party to CITES and CMS (CITES 2018a, CMS 2018). Tanzania has six main categories of land with wildlife-related activities (covering 317,000 km<sup>2</sup>), with some allowing no consumptive use (CITES 2002a). Tanzania's 2009 Wildlife Conservation Act and 2002 National Parks Act are the main laws relating to wildlife trade and trafficking (Monk et al. 2014b). Further, wildlife conservation is guided by the Wildlife Conservation (Tourist Hunting) Regulations of 2015 and the CITES Implementation Regulations of 2005 ([Annex 4](#), CITES 2018b). The National Parks Act is the main statute for controlling hunting, poaching and wildlife trade and manages hunting and poaching of animals within NPs. To hunt, capture, kill, possess or remove any animal in national park, a permit is needed (Monk et al. 2014b).

The leopard population is managed according to the Carnivore Action plan ([Annex 4](#), CITES 2018b). The hunting season for leopards lasts from 1 July to 31 December. At the beginning of the season,

the Wildlife Division grants leopard quotas with each hunting block allocated a quota of 0 to 5 animals (CITES 2002a). “Quota setting for leopard is based on available information on species distribution, natural breeding history, recruitment rate and population estimates” ([Annex 4](#), CITES 2018b). Only male leopards may be shot and the animal must measure at least 1.3 m (from the tip of the nose to the base of the tail; CITES 2002a). Funds generated from tourist safari hunting are beside others used for conservation and anti-poaching programmes ([Annex 4](#), CITES 2018b).

### *Uganda*

The leopard is extant occurring inside and outside of PAs, but is also extinct or possibly extinct across large parts of the country (Jacobson et al. 2016, Stein et al. 2016). The leopard is extant in *northern and eastern Uganda*, in *greater Virunga* and around *Lake Mburo* in the south (Jacobson et al. 2016). Leopards exist in the Greater Virunga landscape, Queen Elizabeth, Mt Elgon, Murchison Falls and Kidepo valley NPs, Ajai, Bokora, Pian-Upe and Toro-Semiliki WRs and Maramagumbo Forest Reserve, Matheniko, Bokora, and Pian upe WRs and possibly in the Imatong Mountains close to South Sudan, Lake Mburo area and the Rwenzori Mountains (Degeorges & Reilly 2008, UWA 2012, Jacobson et al. 2016). In Kibale NP, leopards are at best transient. The extant leopard range was estimated at 65,100 km<sup>2</sup> with PAs covering 17,742 km<sup>2</sup> (27.3%) of extant leopard range (Jacobson et al. 2016). The leopard in Uganda is considered to have drastically declined, to occur at a low density and to number possibly less than 150–200 individuals (UWA 2012).

Uganda is a Party to CITES and CMS (CITES 2018a, CMS 2018). Leopards are listed as a fully protected species in the Uganda Wildlife Act of 1996 (Allen et al. 2014). The Act is administered by the Uganda Wildlife Authority and is the principal framework for regulating illegal trade in the country. Any wildlife utilisation is subject to an evaluation process and granting of a Wildlife Use Right license under the Uganda Wildlife Act. These are only granted to professional hunters and operators. (Allen et al. 2014). Wild animals are the property of the government as long as they are not lawfully granted to any person (Allen et al. 2014). There are strict laws for sport hunting and the killing, capturing or hunting of protected species as well as trading, importing, exporting and re-exporting of wildlife specimens is not allowed without a permit. In 2013, Uganda created an intelligence unit of 80 trained officers to help prevent wildlife crimes. Ugandan authorities also train wildlife crime law enforcement personnel aiming to increase wildlife crime prosecutions (Allen et al. 2014). A management information system is in place with which illegal wildlife activities can be tracked ([CITES 2007a](#)).

### **Southern Africa**

The extant leopard range in South Africa was estimated at 2,872,200 km<sup>2</sup>. “Also in southern Africa, the so called stronghold of the leopard there is no evidence that leopard populations have remained stable” (Stein et al. 2016). The species lost 28–51% of its historic range in southern Africa. Leopards are considered to be declining in Angola, Zambia, Zimbabwe, South Africa and Mozambique with leopards disappearing from areas of increased human development and areas of intensive human-leopard conflict. However, these countries are thought to have healthy populations outside of human-dominated areas. Leopards are considered extant in Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Eswatini (Swaziland), Zambia and Zimbabwe and possibly extant in Lesotho.

### Angola

The leopard is extant (Stein et al. 2016). Angola is thought to have a declining leopard population, but with healthy populations outside of human dominated areas (Stein et al. 2016). According to the latest report from the Ministerio do Urbanismo e Ambiente (MINUA 2006), the leopard is widespread but not abundant in the country. The leopard was recorded in Kisama NP, Iona NP, Luando NP and Bikuar NP, but only in low numbers (MINUA 2006), and in Luiana NP (P. Funston pers. comm.). In Kisama NP, the leopard population was reported as significantly reduced and in Ruacan Regional Nature Park the leopard is considered almost extinct (MINUA 2006). According to the Embassy of the Republic of Angola in Washington D.C. (no date), leopards also occur in Kameia NP. Leopards are believed to be extant in the east and south of the country, *Quicama* as well as in the northern part of Cabinda which makes part of the larger area in the *West Congo basin*. The leopard is possibly extant in *northern Angola near the mouth of the Congo River* and in *southern Zaire*, and to possibly extinct in *western Angola*, while it is considered extinct in the *scattered Congo Basin tropical forest*, around *Luanda*, in *central Angola*, in the north and in the *Etosha Pan and north* (Jacobson et al. 2016).

The extant leopard range was estimated at 678,600 km<sup>2</sup> with PAs covering 60,723 km<sup>2</sup> (8.9%) of extant leopard range (Jacobson et al. 2016).

Angola is a Party of CITES and CMS (CITES 2018a, CMS & UNEP 2011). The MINUA is responsible for implementing and managing environmental policies (Obank et al. 2015). In 1955, Decree 40:040 was issued to protect land, flora and fauna. It defined hunting and game areas and stated the requirements for obtaining a hunting licence, which is needed to hunt leopards. (Obank et al. 2015). Decree 2:873 from 1957 defined hunting areas, protected zones and game reserves as well as the hunting period and parameters of hunting permits and licences. Resolution 1/10 from 2010 contains general guidelines for wildlife protection (Obank et al. 2015). Other relevant legislation addressing illegal wildlife activities are contained in Legislative Diploma 2:873 regarding hunting regulations, Decree 16489 as amended by law in 2012 regarding the Penal Procedure Code, Resolution 42/06 regarding Strategy and National Action Plan for Biodiversity and Law 15/05 regarding Basic Law on Agriculture Development (Obank et al. 2015).

### Botswana

Leopards are extant and widely distributed across the country with continuous populations in the north and west (Stein et al. 2016). The large, continuous area of *central Southern Africa* where the leopard is extant includes the majority of Botswana (Jacobson et al. 2016). Leopards were reported across the Greater Mapungubwe Transfrontier Conservation Area (Shashe-Limpopo Predator Research Group 2010). The leopard is possibly extinct in the *southern Okavango and Xai Xai*, as well as in the *southern Africa unprotected lands* in the east and south-east of Botswana. In a small area around *Francistown* and in the transboundary area with *eastern Namibia*, the leopard is extinct. The extant leopard range was estimated at 367,200 km<sup>2</sup> with PAs covering 107,761 km<sup>2</sup> (29.3%) of the extant leopard range (Jacobson et al. 2016). About 18% of Botswana's land area consists of national parks and game reserves where only 'non-consumptive' tourism is allowed. A further 22% of land in the country is designated as wildlife management areas where hunting is possible (Barnett & Patterson 2005; see below).

Leopard abundance for predator management units was estimated at 5,617 animals (CARACAL no date). Botswana is divided into a northern and southern zone and subdivided by land use. "*The Predator Strategy estimated between 4,404 and 6,830 leopards in these four zones*" (Jacobson et al. 2016). In the Northern (including Okavango, Kwando/Chobe, Dry North, Pandamatenga and Pans

management units) and Southern (Central Kgalagadi Game Reserve, Kgalagadi wildlife management area and the Kalahari Transfrontier Park) Conservation Zone the leopard population was large and stable. In the Northern and Southern Agriculture Zones leopard populations had a lower density (Jacobson et al. 2016).

Botswana is a Party to CITES (CITES 2018a). Leopards are only partially protected in the country under the Wildlife Conservation and National Parks Act (1992; Boast 2014, Hall et al. 2014). Partially protected species “*can be hunted or captured with a licence or permit issued by the Department of Wildlife and National Parks DWNP*” (Boast 2014). Leopards can be killed in defence of human life or if they are damaging or threatening any property outside a NP or Game Reserve (CARACAL no date). In January 2013, a moratorium on hunting permits for leopards was issued on public areas due to high declines in wildlife populations and cross border and domestic poaching incidents (Republic of Botswana 2012, Boast 2014). Military forces are protecting wildlife in some areas (Hall et al. 2014). The primary statute addressing hunting, poaching and wildlife trade in the country is the Wildlife Conservation and National Parks Act 1992 which defines who can hunt what and where. The Wildlife Conservation Policy 1986 aimed to further develop the commercial wildlife industry on a sustainable basis (Hall et al. 2014). The Wildlife Conservation and National Parks Regulations from 2001 address hunting and licensing. Licences are needed for hunting any game animal in the country and permits must be obtained for imports, exports or re-exports (Mauck 2013).

Hunting is a citizen’s right, not a privilege, with licenses allocated between Controlled Hunting Areas with citizen hunting, community-managed areas, and private/commercial licenses (Barnett & Patterson 2005). Hunting quotas in the country were allocated to regions, depending on the sex and age of leopards taken in the previous season (Balme et al. 2010b). The entire country is divided into Controlled Hunting Areas, some of them designated for community use. Each Controlled Hunting Area receives its hunting quota by the DWNP (Abensperg-Traun 2009). Organised communities with a Quota Management Committee are allowed to manage the quota of their area by themselves (Abensperg-Raun 2009).

DWNP based their national leopard quota allocation each year on estimations of leopard home ranges. 22 hunting permits were allocated across Botswana to game farms larger than 80 km<sup>2</sup>, with one permit per person (Kent 2011). The introduction of an age-based leopard trophy hunting system in 2009 led to a decline in national leopard trophy hunting quotas on game ranches from 46 in 2007 to 15 in 2012 (Boast 2014).

### *Eswatini (Swaziland)*

The leopard is extant in the north and south-east (Stein et al. 2016). However, the leopards in Eswatini are suspected to be transient animals from bordering high leopard density areas in South Africa. The extant leopard range in South Africa is estimated at 10,100 km<sup>2</sup> with PAs covering 454 km<sup>2</sup> (4.5%) of the extant leopard range (Jacobson et al. 2016).

Eswatini is a Party to CITES and CMS (CITES 2018a).

In the Red List of Mammals of South Africa, Eswatini and Lesotho the leopard is listed as Vulnerable (Williams et al. 2017).

### *Lesotho*

The leopard is possibly extinct (Stein et al. 2016). A report on Lesotho’s biological diversity by the National Environmental Secretariat and a field guide to mammals of Southern Africa reported the



leopard to be present in the mountains, and in parts of Quthing, Qacha's nek, Mokhotlong and Buta-Buthe districts, respectively. In 2008, respondents in an interview survey stated that leopards were still present but rare in various areas, such as Ketane, Libibing, Liphiring and Ha Kotsane (Morake 2010). Leopards are considered present in a few habitats in the highland area of the Ts'ehlanyane NP (Anonymous no date).

Lesotho is a Party to CITES (CITES 2018a). PAs occupy 138 km<sup>2</sup> (0.4%) of Lesotho (Bureau of Statistics 2015). In the Red List of Mammals of South Africa, Eswatini (Swaziland) and Lesotho, the leopard is listed as Vulnerable (Williams et al. 2017).

### *Malawi*

The leopard is extant but largely absent from the country (Stein et al. 2016). Leopards are extant in three isolated areas: in the north (as part of the continuous, transboundary patch across *central Southern Africa*), in *Nkhota-Kota* in the center, and in *Majete* in the south (Jacobson et al. 2016). Leopards were reported from Kasungu NP, Liwonde NP and Mulanje Mountains (ALERT no date, NORAD 2009, Waterland et al. 2015). The species was considered to be extirpated from Liwonde NP, Majete WR and Lengwe NP and to be rare in Mwabvi WR (Purchase et al. 2007). Leopard populations seem to have declined in the north of Malawi, in Nyika NP and leopard numbers are considered to be low in Liuwa plains NP (Purchase et al. 2007). The extant leopard range in Malawi was estimated at 11,100 km<sup>2</sup> with PAs covering 7,733 km<sup>2</sup> (69.7%) of extant leopard range (Jacobson et al. 2016).

Malawi is a Party to CITES (CITES 2018a). Laws that address wildlife offences include the National Parks and Wildlife Act No. 11 of 1992, the National Parks and Wildlife Regulations from 1993 and 1994 and the National Parks and Wildlife Order from 1994 (Mauck 2013).

### *Mozambique*

The leopard is extant (Stein et al. 2016). Leopards are obviously quite common in Niassa NR and the status of the leopard is possibly still secure (Begg & Begg 2007). Leopards were reported in Banhine NP, Gornogosa NP, Limpopo NP, Gil NR, Xonghile Game Reserve and Maputo Special Reserve (Purchase et al. 2007, Lindsey & Bento 2012, Strampelli 2015, Jacobson et al. 2016, [Annex 1](#) CITES 2018b). Leopards may still persist in northwest Tete Province (Jacobson et al. 2016). The species is extant in a transboundary area in the north, which covers *Kenya, Tanzania and north Mozambique*, in *Gile* and adjacent areas, in *Marromeu and central Mozambique*, and in the south-west as part of a continuous, transboundary area centred on *Kruger* NP in adjacent South Africa. It is also thought to be possibly extant in the *northern Zambezi province* and to be extinct in *north-eastern coastal Mozambique*, areas bordering Malawi, *central coastal Mozambique*, *south-eastern coastal Mozambique* and *Maputo Bay*. The extant leopard range in Mozambique was estimated at 457,000 km<sup>2</sup> with PAs covering 66,738 km<sup>2</sup> (14.6%) of the extant leopard range by Jacobson et al. (2016). In the review of leopard quota and non-detriment determinations conducted by the National Administration for Conservation Areas of Mozambique, the precautionary leopard range however was estimated at 640,000 km<sup>2</sup> (i.e. covering 80% of the country) and the Conservation Areas to cover 219,231 km<sup>2</sup> (28% of the country).

The leopard is considered to be not threatened nor endangered in Mozambique ([Annex 1](#), CITES 2018b). In Mavago, Mecula and Negomano (all part of the Niassa NR), a total of 256 leopards were estimated in 2014 (NCP 2014). The leopard population is assessed as declining in Mozambique but to have healthy populations outside of human dominated areas (Stein et al. 2016).

Mozambique is a Party to CITES and CMS (CITES 2018a, CMS 2018). The country contains an extensive network of PAs (CITES 2007b). The system of Conservation Areas includes seven NPs, eight NRs, 17 Forest Reserves, 20 official hunting reserves (*coutadas*) and two Community Conservation Programs ([Annex 1](#), CITES 2018b). The wildlife is protected in these areas. *“Since 2015 the Ministry of Land, Environment and Rural Development is responsible for all wildlife management in the country implementing the new Conservation Law 16/2014 (5/2017) and the Human-Wildlife Conflict Mitigation Strategy”* ([Annex 1](#), CITES 2018b). The National Administration of Protected Areas (ANAC) is responsible for implementing hunting legislation and allocating hunting quotas. Legislation for wildlife includes the Decree of the Council of Ministers 34/2016, Decree 82/2017 (hunting regulation) and the Law on the Protection, Conservation and Sustainable Use of Biological (Law 5/2017) and its Regulations (Decree 89/2017; Obank et al. 2015). In 2014, the Conservation Law (Law 5/2017) was passed and approved by Parliament in 2016. It aims to increase the protection, conservation and sustainable use of wildlife by implementing stricter rules. The law does not specify under which circumstances endangered or protected species could or should not be hunted but the Wildlife Decree does specify protected species and prohibits their hunting (Obank et al. 2015; [Annex 1](#) CITES 2018b). Hunting was regulated by the Forestry and Wildlife Law but since 2017 hunting is regulated through law 5/2017 and its Regulations (Decree 89/2017) and the Hunting Regulation included in Decree 83/2017 ([Annex 1](#), CITES 2018b). Commercial hunting and hunting to defend property or life is allowed if it is not possible to capture or drive the animal away (Obank et al. 2015). Tourist safari hunting is managed and regulated at the national level through a quota system. Hunting quotas are allocated to *coutadas* (Hunting reserves) and hunting blocks around Niassa NR, Community Programmes, hunting blocks and Game Farms. For local national hunting no quota is provided. Quotas are set by the ANAC, Provincial Authorities and Safari Operators based on information from specific studies, from authorities at the National Provincial and district level and from concessionaires of hunting areas. *“Management is adaptive with formal oversight and feedback through mandatory safari operators’ annual reports”* ([Annex 1](#), CITES 2018b). Hunting concessions are awarded to private safari operators generally for 5 years. The revenues from safari operators and sport hunters are invested in the operational costs of Conservation Areas such as anti-poaching salaries and equipment ([Annex 1](#), CITES 2018b). Hunting of leopards is restricted to the season April–November and only leopard trophies of minimum 1.20 m can legally be harvested ([Annex 1](#), CITES 2018b). *“An important monitoring tool is represented by the regular verification of the conditions included in the Management Plan of the hunting are, in the Annual Plan and in the Annual Activity (Hunting) Report”* ([Annex 1](#), CITES 2018b). Safari operators must provide Annual Activity (Hunting) Reports. Leopard harvest is monitored through the trophy ownership certificates issued and through periodical visits to the hunting areas by the provincial offices of Ministry of Land, Environment and Rural Development. Databases to efficiently monitor and supervise information on sport hunting and for wildlife monitoring are currently developed.

Sport hunting is an important source of revenue for Mozambique (CITES 2007b, Jorge 2012). The leopard is one of the most important trophies in the Niassa NR and has a high value for sport hunters (Jorge 2012). In Niassa Province in Mozambique, trophy quality was assessed to determine and promote sustainable leopard harvest. *“Quotas are assigned independently to regions depending on the sex and age of animals taken in the previous hunting season. These systems are self-regulating and encourage ecologically sound hunting by penalizing hunters that shoot females or under-aged leopards”* (Balme et al. 2010b). In Niassa NR, conservation activities are to a large extent funded through sport hunting revenues (Jorge 2012, NCP 2014). The Niassa NR is one of few PAs generating revenues for the Mozambique government. Most of these revenues remain however at the national and inter-

national level, with little economic benefits for local communities directly interacting with leopards (NCP 2012).

### *Namibia*

The leopard is extant (Stein et al. 2016). Leopards are quite widespread across the country also outside of PAs, but absent in the highly populated northern region, the desert coast and arid farmlands in the southeast (Stein et al. 2012). The Large Carnivore Atlas of Namibia showed most observations in the centre and the north-east of the country with few records from the coast and the south (Hanssen & Stander 2003). Leopards were confirmed in Waterberg NP and the surrounding farmlands (Stein 2008), in the Okomitundu (Föster & Föster 2008), on farms in the Northern Kalahari, in the Karas Dwarf Shrubland (Lindsey et al. 2013a) and Bwabwata NP (Jacobson et al. 2016). The leopard possibly still exists in Eengodi, Omuntele and Epembe (Henghali 2006).

The leopard is thought to be extant throughout most of the country including isolated patches of Kalahari savanna in the east and south-east, but extinct in *eastern Namibia*, small areas *east and north of Grootfontein*, south of *Otjozondjupa*, in the *eastern Kunene region* and in the *Etosha pan and north*. Leopards are thought to be absent from 29% of the country (238,091 km<sup>2</sup>), including portions of the Skeleton Coast and farmlands in the southeast (Stein et al. 2012). The extant leopard range was estimated at 568,900 km<sup>2</sup>, of which PAs cover 106,866 km<sup>2</sup> (18.8%; Jacobson et al. 2016).

The leopard population in Namibia was in the Large Carnivore Atlas estimated at 8,039 (5,469–10,610) individuals based on sightings (Hanssen & Stander 2004). Mendelsohn (2006) estimated the leopard population at 8,000, with 2,000 individuals inhabiting PAs, 2,000 occurring on communal areas and 4,000 found on freehold lands. Stein et al. (2012) estimated that leopards have healthy population numbers in Namibia of 14,154 (13,356–22,706). The leopard population is considered to be stable and increasing ([Annex 2](#), CITES 2018b).

Namibia is a Party to CITES (CITES 2018a). The leopard is listed in the country as Specially Protected under the Nature Conservation Ordinance and is classified as protected game (Obank et al. 2015). Protected game animals can only be hunted with a permit from the Minister of Environment and Tourism. Land owners or occupiers of land can kill leopards without permit in defence of life and to protect livestock, but they have to report the kill to the Ministry of Environment and Tourism (CITES 2004a; Barnett & Patterson 2005). Wildlife protection legislation includes: the Nature Conservation Ordinance 1975 concerning hunting regulations, the Nature Conservation Amendment Act 1996, the Game Products Trust Fund Act 1997 and the Controlled Wildlife Products and Trade Act 2008, dealing with the trade, import, export and possession of wildlife products (Obank et al. 2015). The Nature Conservation Ordinance is the main legislation regarding prevention of wildlife crime, sustainable use and conservation. The Conservancies Amendment Act from 1996 recognises the need for proactive wildlife management. Conservancies, managed by communities, were established to provide communities with the same rights over wildlife and tourism as farmers which seem to minimise poaching and give wildlife a valued livelihood asset (Obank et al. 2015). The regulatory framework for conservancies is overseen by the Ministry for Environment and Tourism, which also controls hunting permits. The system of conservancies in Namibia has been praised as pioneering the incentive-based approach towards wildlife conservation (Obank et al. 2015). Hunting of any animal in national game parks or nature reserves is prohibited without the permission of the State. Under the Trust Fund Act, any benefits from game products will go back to the conservancies and are used to promote rural development. The fund “*provides incentive for local communities to establish conservancies [...]*” (Obank et al. 2015). The Wildlife Trade Act was created in 2008 and deals with the trade, import,

export and possession of wildlife products (Obank et al. 2015). Only adult male leopards with a minimum skull measurement of 32 cm are allowed to be trophy hunted ([Annex 2](#), CITES 2018b). Leopard hunting quotas are allocated at a national level, based on the size of land and available scientific information (e.g. population size, hunting success rate, density, human-wildlife conflict incidences). *“In the absence of population estimates, trophy quality and trend assessment are used as a guide to determine population status of the species in the area”* ([Annex 2](#), CITES 2018b). The off-take of leopards is well monitored ([Annex 2](#), CITES 2018b).

In Namibia, following requests for more trophy hunting permits to be issued in 2010, a national leopard survey was initiated and trophy hunting was assessed (van Schalkwyk 2014, Stein et al. 2016). As a result, new regulations on leopard trophy hunting in Namibia were published and the leopard moratorium on trophy hunting was lifted in 2011 (van Schalkwyk 2014). In order to include problem leopards into trophy hunting, a hunters' hotline was established that links farmers with livestock damages to the Professional Hunters Association (Balme et al. 2010b). This partially resolved the problem of sourcing available clients at short notice, but it did not encourage farmers to improve their livestock husbandry practices which could help against leopard attacks and only around 12% of the farmers used the hotline (Balme et al. 2010b).

### *South Africa*

Leopards are extant (Stein et al. 2016). The species occurs in many PAs but their habitat is severely fragmented. Leopards are absent from large parts of the country, mainly the centre. Only around 20% of land is considered suitable for them, mainly lying outside of PAs (Swanepoel et al. 2013, Stein et al. 2016). Their range is mainly restricted to the Cape Fold Mountain ranges and the borders with Botswana, Lesotho, Mozambique, Namibia, Eswatini (Swaziland) and Zimbabwe (Jacobson et al. 2016). Leopards are extant in *central Southern Africa*, in *Kruger and eastern Southern Africa*, in the *Drakensberg mountains*, in the *KwaZulu-Cape forest mosaic* and in *southern South Africa*. Leopards were recorded in Addo Elephant NP, Greater Mapungubwe Transfrontier Conservation Area, Kgalagadi Transfrontier Park (formerly Kalahari Gemsbok NP), Kruger NP, Sabi Sands GR, Londolozi GR, Karongwe Private GR, Mukhuze GR, Phinda Private GR, Zululand Rhino Reserve, Baviannskloof mountain wilderness (Daly et al. 2005, Balme et al. 2010a, Chase-Grey 2011, Jacobson et al. 2016). The extant leopard range is estimated at 401,300 km<sup>2</sup>, of which PAs cover 33,894 km<sup>2</sup> (8.4%; Jacobson et al. 2016).

The leopard population in South Africa was estimated at 4,250 (2,185–6,750) individuals (Daly et al. 2005). In 2005, leopards in the Greater Kruger, Limpopo, Western Cape and Kalahari were predicted to do well, the Waterberg/Mpumalanga and KwaZulu-Natal populations to suffer intense legal and illegal hunting levels and the remaining small populations in Orange River Basin, Eastern Cape (Mountains and Valley) and Wild Coast to face a significant risk of extinction (Daly et al. 2005). Without considering illegal hunting, the extinction risk for all leopard populations over the next 100 years was zero (except for the Wild Coast population with a risk of 1%; Daly et al. 2005). Swanepoel et al. (2014) predicted a persistent risk of declines for the leopard populations of the provinces Limpopo, Mpumalanga, KwaZulu-Natal and Western Cape and the population of whole South Africa. The South African Leopard Monitoring Project suggests an 8% decline in the national leopard population per year and in five of 18 sites surveyed in 2017 significant declines in leopard density were observed ([Annex 3](#), CITES 2018b). *“Some stable populations (e.g. Somkhanda and Manyoni) appear to be well below their potential capacities, while other sites such as Barberton and Songimvelo in Mpumalanga,*

*Ophate in KwaZulu-Natal and Dinokeng in Gauteng appear to no longer have functioning leopard populations”* ([Annex 3](#), CITES 2018b).

South Africa is a Party to CITES and CMS (CITES 2018a, CMS 2018). In the Red List of Mammals of South Africa, Eswatini (Swaziland) and Lesotho the leopard is listed as Vulnerable (Williams et al. 2017) as well as in terms of section 56 of the National Environmental Management: Biodiversity Act 10 of 2004. The leopard population is declining ([Annex 3](#), CITES 2018b). The leopard is listed as a protected species in the country (Obank et al. 2015). The leopard is classified as ‘specially protected game’ in KwaZulu Natal Province and is strictly protected inside provincial public parks (Balme et al. 2010b). The principal legislation in regard to wildlife protection is the National Environmental Management: Biodiversity Act, Act 10 of 2004. This Act is supported by the Threatened or Protected Species Regulations which regulate the hunting, breeding and trade of leopards and other large predators. Across South Africa, permits are required to hunt, catch, convey, sell, import, export or kill leopards. These are issued by the provincial nature conservation authorities based on the national Threatened and Protected Species regulations (Lindsey et al. 2011a). Trophy hunting and legal damage causing animal control is formally managed at the provincial level ([Annex 3](#), CITES 2018b). Provincial authorities carry out implementation of national legislation and regulations, but each province has its own laws (Obank et al. 2015). Leopard hunting quotas are allocated by the Department of Environmental Affairs to the provinces after reviewing the requests of the provincial departments (Lindsey et al. 2011a). Only the province Kwa-Zulu-Natal and Mpumalanga had official guidelines for managing leopard trophy hunting. In Kwa-Zulu-Natal the sex (male) and age (>4 years) of leopards to be hunted was defined (Lindsey et al. 2011a). Trophy hunting guidelines and protocols including the age, sex and number of leopards that should be harvested have been developed (Balme et al. 2010b, 2012b). *“Leopard hunting quotas are adjusted annually based on population trend data generated by the South African Leopard Monitoring Project”* ([Annex 3](#), CITES 2018b). Hunting is not allowed in areas with declining leopard populations and in areas where scientifically robust data on leopard populations’ trends are missing. Thus, hunting is only allowed where leopard populations are increasing or stable indicated by scientifically robust data ([Annex 3](#), CITES 2018b).

In 2010, a non-detriment finding (NDF) assessment for trophy hunting of leopards in South Africa was conducted to assess the sustainability of the trophy export quota (Lindsey et al. 2011a). The NDF was performed due to the increase in CITES leopard hunting quotas from 75 to 150 in 2004 despite insufficient information on leopard population status or trends and without a NDF assessment (Lindsey et al. 2011a). The NDF assessment resulted in a *“conditional acceptance of the quota of 150 for a period of five years, contingent on monitoring programmes being implemented and efforts being implemented to prevent clumping of off-takes”* (Lindsey et al. 2011a). It was agreed, that monitoring of leopard populations to study densities and abundance, research on illegal leopard harvest, a national leopard management plan to standardise trophy hunting management, standardised data capture on leopard harvest and effective trophy hunting monitoring to prevent clumping of leopard off-takes and to allow adaptive management are important and urgently needed (Lindsey et al. 2011a). Moreover, *“provision of adequate data related to trophy hunting and other forms of leopard harvest by provincial departments of the Department of Environmental Affairs should be a pre-requisite for provinces to qualify for hunting quotas”* (Lindsey et al. 2011a). A hunt-return form where hunting methods, location, time, gender and genetic samples of the hunted leopards is noted, should be used for trophy hunting and detailed information on damage-causing animal permit issued should be recorded (e.g. validity, previous permits issued, sex, age, weight of the leopard, etc.; Lindsey et al. 2011a).

## Zambia

Leopards are extant but considered extinct or possibly extinct in large parts (Jacobson et al. 2016, Stein et al. 2016). Leopards occur on more than 80% of the extensive wildlife ranches in the country, though in less than 20% of fenced wildlife ranches and in no non-wildlife ranches (Lindsey et al. 2013b). The leopard is extant in *Nsumbu* in the north, in the *Bangweulu swamps and GMAs*, in the *Kafue ecosystem*, in the south-west along parts of the border with Namibia and Angola and along the Luangwa River (Jacobson et al. 2016). Leopards were recorded in Luambe NP and adjacent GMAs, Chiawa GMA, in the Lower Zambezi NP, in South and North Luangwa NP, Sioma Ngwezi NP, Kasanka NP, Lavushi Manda NP, Luambe NP, Lukusuzi NP and in the GMAs Kafinda, Lumimba, Pupande, Mukungule, Munyamadzi, Mupunda, Musalangu, Sandwe and Tondwa ( Ray 2011, Jacobson et al. 2016). Leopards possibly occur in the GMAs West Petauke, Rufunsa, Kasonso-Busanga and West Zambezi. The species is possibly extant in the Liuwa plains, Lavushi Manda and in the Lusenga plain as well as in the GMAs Chambeshi, Kapua, Luwingu and Mansa. Leopards have gone extinct around Lusaka, in the copper mining regions bordering the DRC and in the areas bordering Tanzania and Malawi. The extant leopard range in Zambia was estimated at 218,000 km<sup>2</sup>, of which PAs cover 52,638 km<sup>2</sup> (24.1%; Jacobson et al. 2016). The leopard population in Zambia is thought to be declining but to be healthy outside of human dominated areas (Stein et al. 2016).

Two main leopard populations in the Kafue and Luangwa Ecosystem comprising of several NPs and GMAs were identified and five smaller satellite populations in the northwest in the Lunga NP, Liuwa NP and the Sioma-Ngwezi NP, and in the NPs and GMAs in the Bangweulu area and Lake Mweru-Wantipa area. The leopard population in the country is believed to exceed 2,000-4,000 animals ([Annex 5](#), CITES 2018b).

Zambia is a Party to CITES (CITES 2018a). The leopard is listed as a game animal in a statutory order from 2015 created by the Minister of Tourism, Environment and Natural Resources, and as a dangerous animal in the Zambia Wildlife Act (Obank et al. 2015). The main legislation addressing wildlife issues in the country was the 1998 Zambia Wildlife Act, which was replaced by the Zambia Act No. 15 of 2015 and the 2007 Zambia Wildlife Regulations. The Zambia Wildlife Regulations manage the import, export and re-export of species listed in the CITES Appendices and regulates international trade in endangered species (Obank et al. 2015). The Zambia Act No. 15 is the main statute for regulating illegal wildlife trade. The Wildlife Management Licensing Committee is responsible for licenses, permits and certificates. The Department of National Parks and Wildlife is responsible for issues of poaching or illegal harvesting of wildlife ([Annex 5](#), CITES 2018b). Hunting in NPs is only allowed with a special permit and in GMAs with a license. Trophies can only be traded with a permit from the Zambian Wildlife Authority. Selling or buying of a live game animal or protected animal or its meat is prohibited without certificate. Import and export of wild animals or their meat is only allowed with the correct permits (Obank et al. 2015). Quotas are set in a participatory process. For setting leopard quotas information from field observations from professional hunters, operators and field officers and from hunting records is used. "Quota setting is done for each hunting block in GMAs for all types of hunting after the close of the hunting season and prior to the next hunting season" (Annex 5, CITES 2018b). Sport hunting operators must provide a certain percentage of the meat obtained from sport hunting annually to local communities, constituting an important source of protein and potentially reducing unsustainable bushmeat hunting (White & Belant 2015).

Zambia has 20 NPs, which cover 64,000 km<sup>2</sup> (8.5% of the country's area) and 36 GMAs, constituting about 170'000 km<sup>2</sup> (22%; Lindsey et al. 2014). GMAs are situated next to NPs and allow regulated consumptive tourism for some protected species. 10 of the 36 GMAs have some non-consumptive

tourism (Simasiku et al. 2008). Conservation areas (NPs and GMAs) are monitored by the Zambian Wildlife Authority (ZAWA), which acts under the guidance of the Minister of Tourism, Environment and Natural Resources. Among ZAWA's tasks is regulation of trade and transport of species. In 2013, ZAWA banned the hunting of big cats due to a decrease in numbers and due to "*allegations of corruption in the award of safari hunting concessions*". The ban did not apply to GMAs and was lifted in 2015 (Obank et al. 2015).

### *Zimbabwe*

The leopard is extant, but thought to be mainly occurring in PAs (Stein et al. 2016). In Zimbabwe, much leopard range has disappeared due to the resettlement of private farmland and subsequent loss of prey populations. The species was recorded in Hwange NP, Mana Pools NP, Matusadona NP, Hwange, Zambezi, Matetsi, Chirisa, Chete, Charara, Hurungwe, Chewore, Doma and Umfurundzi Sarai Areas as well as across the Greater Mapungubwe Transfrontier Conservation Area (Wilson 2006, Purchase et al. 2007, Shashe-Limpopo Predator Research Group 2010).

According to Jacobson et al. (2016), leopards are extant in the transboundary areas along the northern, western and southern borders, as well as in *Umfurudzi safari area* and *Kyle and Mushandike sanctuaries*. The leopard is possibly extinct in the majority of unprotected areas and extinct in *central Zimbabwe* around Harare. The extant leopard range in Zimbabwe was estimated at 160,000 km<sup>2</sup> with PAs covering 26,769 km<sup>2</sup> (16.7%) of the extant leopard range (Jacobson et al. 2016). Zimbabwe is thought to have a declining leopard population but with healthy populations outside of human dominated areas (Stein et al. 2016).

Zimbabwe is a Party to CITES and CMS (CITES 2018a, CMS 2018). The leopard is not contained on the list of specially protected animals (Obank et al. 2015). The main legislation in regard to wildlife in Zimbabwe is the Parks and Wildlife Act 22/2001. The Protection of Wildlife Indemnity Act 21/1989, the Trapping of Animals Act 34/1973 and the Environmental Management Act 13/2002 address wildlife issues and allowed hunting methods. The Parks and Wildlife Act aims to protect and conserve the wildlife of Zimbabwe. The responsible legal authority for the conservation and protection of wildlife is the Zimbabwe Parks and Wildlife Management Authority, which manages five different categories of Parks & Wildlife estates, differing in restrictions for wildlife use, and also has anti-poaching functions (Obank et al. 2015, Zimparks 2015). Hunting of and trading in animals, and trading of trophies, without a permit is prohibited. Additionally, to a penalty, compensation payments have to be made when species are hunted without a permit on protected land, which depend on the species of animal involved (Obank et al. 2015). Only hunting of male leopards is allowed and trophies with a skull size smaller than 13 and  $\frac{3}{4}$  inches (width plus length;  $\approx 35$  cm) are not allowed to be exported (Lindsey & Chikerema-Mandisodza 2012). Leopard quotas are set based on information from monitoring and input from stakeholders (i.e. research staff, local communities, hunting operators, researchers). Quotas are allocated to state and private land-owners through a quota allocation system done once a year. In a participatory process stakeholders collect and deliberate on hunting quotas including population data, trophy quality data and habitat and land tenure factors ([Annex 6](#), CITES 2018b).

## 2.3 Use and trade

‘Non-consumptive use’ of leopards is e.g. wildlife viewing. Legal ‘consumptive use’ takes place through (trophy) hunting and permitted killing of damage-causing leopards, illegal through poaching or retaliation killing. The leopard is included in the provisional list of animal species used in traditional medicine compiled by the CITES Animal Committee (CITES 2002b). Parts known to be used for medicinal (or ceremonial) purposes are skins, flesh, bones, fat and hearts (CITES 2002b). In some countries, the meat of the leopard is consumed (Olupot et al. 2009).

Since 1975, the leopard has been included in CITES Appendix I (CITES 2012). In 1983, at the 4<sup>th</sup> CITES Conference of the Parties, the first of a series of resolutions with regard to leopard skin trade was adopted.

Hunting of leopards is prohibited or restricted to “problem” animals in Angola, Algeria, Benin, Burkina Faso, Republic of the Congo, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Gabon, Ghana, Guinea Bissau, Liberia, Mali, Mauritania, Morocco, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Sudan, Togo and Uganda.

In 1983, initial quotas were 80 leopard skins each for Botswana, Kenya, Zambia and Zimbabwe, 60 each for Mozambique and Tanzania, and 20 for Malawi (CITES 1985a). Further CITES resolutions regarding leopard skin trade followed after Resolution Conf. 4.13 (CITES 1985b, 1989a, 1989b, 1992, 1997, 2002c, 2004b, 2007c, 2012). Quotas for leopard hunting trophies and skins for personal use are specified in CITES Resolution Conf. 10.14 (Rev. CoP16; Jorge 2012). From 1983–2013, the leopard quota of several countries was increased, mainly on the basis of limited data and on the estimates of Martin & de Meulenaer (1988), which were subsequently, considered to be overestimates (Jackson 1989, Norton 1990, Jenny 1996, Nowell & Jackson 1996). The number of countries exporting leopard skins increased from 7 to 12. In all countries the export quota remained stable or increased during the period 2000–2012. From 2000–2017, a minimum of 1,695 (in 2002) to a maximum of 2,703 (in 2017) leopard CITES export quotas were allocated to African countries (Table 2.3.1). Whether the lack of a quota for several countries in the years 2013–2016 and 2018 means a quota of zero or whether the information may still be updated is not clear.



**Table 2.3.1.** The annual CITES quotas allocated for African countries permitted to export leopard trophies and/or skins between 2000 and 2018 (data and notes from CITES 2018c). It is not clear whether the lack of a figure actually means a quota of zero or whether the information is not available or may still be updated. It should be noted that at present, most countries, but not all, issue a number of hunting licenses per year considerably lower than the CITES export quota (CITES 2018b).

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
<b>Botswana</b>	130	130	130	130	130	130	130	130	130	130	130	130	130	-	-	-	-	130	-	
<b>CAR</b>	40	40	40	40	40	40	40	40	40	40	40	40	40	-	-	-	-	40	-	
<b>DRC</b>	-	-	-	5 <sup>1</sup>	5 <sup>2</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	1 <sup>1</sup>	-	-	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>
<b>Ethiopia</b>	500	10 <sup>3</sup> 100 <sup>1</sup>	15 <sup>3</sup> , 200 <sup>1</sup>	500 <sup>3</sup>	500	500	500	500 <sup>3</sup>	500 <sup>3</sup>	500 <sup>3</sup>	500 <sup>3</sup>	500 <sup>3</sup>	10 <sup>3</sup>	-	-	50 <sup>3</sup>	50 <sup>3</sup>	50 <sup>3</sup>	500	500
<b>Gabon</b>	-	-	-	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	5 <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
<b>Kenya</b>	80 <sup>4</sup>	80 <sup>4</sup>	80 <sup>4</sup>	80	80	80	80	80	80	80	80	-	80	-	-	-	-	80	80	
<b>Malawi</b>	50	50	50	50	50	50	50	50	50	50	50	50	50	-	-	-	-	50	50	
<b>Mozambique</b>	60	60	60	60	60	60	60	60	120	120	120	120	120	-	-	120	120 <sup>3</sup>	120	120	
<b>Namibia</b>	100	100	100	100 <sup>5</sup>	100 <sup>5</sup>	250 <sup>5</sup>	250 <sup>5</sup>	250	250	250	250	250 <sup>6</sup>	250 <sup>6</sup>	-	-	250 <sup>3</sup>	250 <sup>3</sup>	250	250	
<b>South Africa</b>	75	75	75	75	75	150	150	150	150	150	150	150	150	-	-	-	-	150	150	
<b>Tanzania</b>	250	250	250	500	500	500	500	500	500	500	500	500	500	-	-	500 <sup>3</sup>	500 <sup>3</sup>	500	500	
<b>Uganda</b>	-	-	-	-	-	-	-	-	28	28	28	28	28	-	-	-	-	28	28	
<b>Zambia</b>	300	300	300	300	300	300	300	300	300	300	300	300	300	-	-	300	300	300	300	
<b>Zimbabwe</b>	500	500	500	500	500	500	500	500	500	500	500	500	500	-	-	500 <sup>3</sup>	500	500	500	
<b>TOTAL</b>	<b>2,085</b>	<b>1,695</b>	<b>1,800</b>	<b>2,345</b>	<b>2,345</b>	<b>2,570</b>	<b>2,570</b>	<b>2,570</b>	<b>2,658</b>	<b>2,653</b>	<b>2,653</b>	<b>2,573</b>	<b>2,163</b>	<b>1</b>	<b>-</b>	<b>1,220</b>	<b>1,725</b>	<b>2,703</b>	<b>2,483</b>	

<sup>1</sup> skins

<sup>2</sup> live

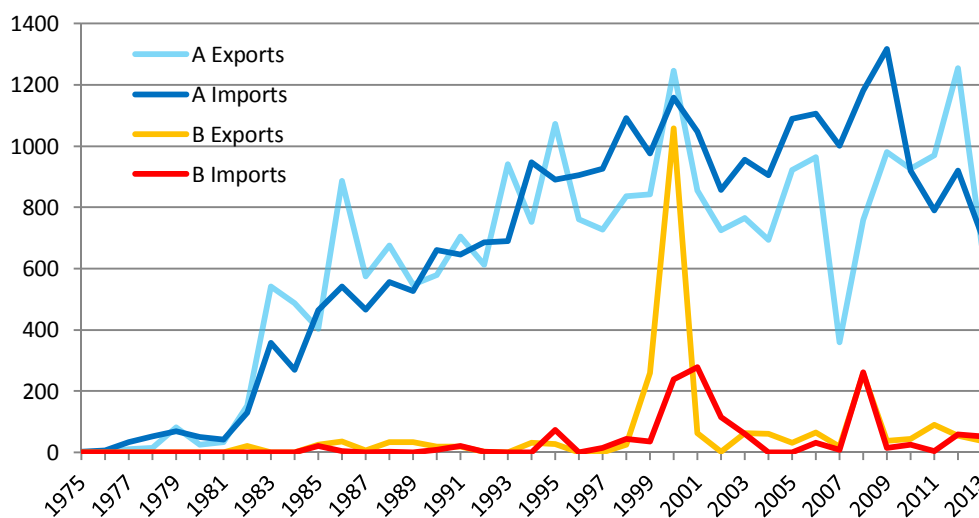
<sup>3</sup> trophies

<sup>4</sup> hunting banned/prohibited

<sup>5</sup> hunting trophies (skins) and live specimens

<sup>6</sup> trophies and skins as personal effects

The trade (reported imports and exports) in leopard items overall increased from 1975 to 2013. Imports and exports for Category B have generally been very low but there have been some significant peaks in certain years (Fig. 2.3.1).



**Fig. 2.3.1.** Reported leopard trade from 1975–2013 for the countries with the highest CITES quotas (Botswana, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe) according to the CITES Trade Database. Category A includes bodies, live animals, skins, skulls and trophies. Category B includes bones, claws and teeth. Light blue: exports for category A from the countries listed above as reported by those countries. Dark blue: imports for category A from the countries listed above as reported by all member Parties to CITES. Orange: exports for Category B from the countries listed above as reported by those countries. Red: imports for Category B from the countries listed above as reported by all member parties to CITES (CITES 2018d).

Some countries have implemented self-imposed hunting moratoriums or bans (Table 2.3.2).

**Table 2.3.2.** Countries where trophy hunting of leopards is/was banned by the national governments and duration of the ban.

Country	Start/Duration	Reference
Botswana	Since 2013 <sup>1</sup>	Republic of Botswana 2012
Kenya	Since 1977	Republic of Kenya 2013
Malawi	?	Waterland et al. 2015
Namibia	2010 <sup>2</sup>	Stein et al. 2016
South Africa	Since 2016	Stein et al. 2016
Tanzania	1973–1978	CITES 1985a
Zambia	2013–2015	Stein et al. 2016

<sup>1</sup>Moratorium only valid on public land.

<sup>2</sup>Already in 2009, Namibia issued no permits for leopard trophy hunting, but a formal one-year-moratorium was put in place in 2010.

The leopard is a key species for the trophy hunting industry (Lindsey 2008, Brackowski et al. 2015). The monetary value of leopard trophies exported for personal purposes and hunting trophies from 2006–2010 was estimated at USD 845,400 (UNEP-WCMC 2013). In addition to trophy fees, trophy hunting generates revenue from daily rates (e.g. for accommodation and staff), travel and safari expenditure, taxidermy, observer rates (e.g. accommodation for non-hunters accompanying their partners), carcass sales and gratuities (de Beer 2009).

Based on the non-detriment finding (NDF) reports submitted by the Parties (see CoP17 Decision 17.114), leopard export quotas under CITES were recently discussed in a Working Group at the 30<sup>th</sup>

meeting of the CITES Animals Committee (Geneva, 16-21 July 2018; see [Executive Summary from Monday 16 July 2018 \(Rev.1\)](#), Point 15), and again at the CITES Standing Committee meeting (Sochi, 1 – 5 October 2018; Executive Summary not yet available). The NDF reports revealed that the export quotas and the actual licenses issued per year do not match. All countries (with one exception) performing trophy hunting on leopards allocate considerably less hunting permits than the quotas would allow.

There is very little information available on the (legal) consumptive use of leopards other than trophy hunting. It is known that leopard skins are used for cultural reasons in the Democratic Republic of the Congo (e.g. in the region of Upemba NP; UICN/PACO 2010) and that the leopard is a totem animal for the Pouvi people in Gabon (Coad 2007). The by far largest use of leopard skins for ceremonial purpose is known from the Nazareth Baptist Shembe Church in southern Africa (Lindsey et al. 2015, Balme et al. 2013). To our understanding, the offtake of leopards for these cultural uses are illegal (Chapter 2.4), but the legal consumptive use of leopards at national level would need further investigations or compilation of information.

In Namibia, between 2004 and 2017 on average 142 leopards were hunted corresponding to 56% annual quota uptake ([Annex 2](#), CITES 2018b). In Mozambique, between 2011- 2017 safari hunting offtakes were around 40-50% of the quota allocated by the Government of Mozambique (which varied between 106-117 per year; [Annex 1](#), CITES 2018b). In South Africa, between 2005-2016, 73 leopard trophies were exported. The Scientific Authority recommended a quota of 7 male leopards seven years or older for 2018 ([Annex 3](#), CITES 2018b). In Ethiopia, about 5 leopards are hunted per year (CITES 2018e). In Tanzania on average 162 leopards were harvested per year corresponding to 32.4% of the national quota ([Annex 4](#), CITES 2018b). In Zimbabwe between 2010-2017, the off-take of leopards varied between 133-186 animals per year ([Annex 6](#), CITES 2018b).

## 2.4 Threats

The major threats to leopards across Africa were identified to be habitat loss and fragmentation, human-wildlife conflict, poaching, prey depletion and unsustainable trophy hunting (Boast 2014, Constant 2014, Daly et al. 2005, Hunter & Barrett 2011, Nowell & Jackson 1996, Ray et al. 2005, Strampelli 2015, Stein et al. 2016). These threats have led to significant reductions and regional extirpations of leopards, especially in North, East and West Africa (Stein et al. 2016).

### Habitat loss and fragmentation

Habitat loss and fragmentation are significant threats to leopards in East, West and Central Africa, and to a lesser extent in southern Africa (Pitman 2012, Stein et al. 2016). Although leopards are quite adaptable, they have limited levels of ecological resilience to human-caused habitat fragmentation and they need large contiguous habitats with low levels of negative human impact to reproduce successfully (Balme et al. 2010a). Increasing habitat loss and fragmentation also negatively impact leopard prey. The consequences are increasing conflicts between leopards and humans due to livestock predation, which results again in more direct persecution of leopards (CITES 2007d).

About 60–70% of the human population in sub-Saharan Africa is self-supporting and relies directly on agriculture and livestock for their livelihood. The human population in Africa is projected to more than double between 2010 and 2050, reaching then over 2 billion people (UN 2013). The area of

cultivated land is projected to increase by approximately 21% (510,000 km<sup>2</sup>) between 2005 and 2050 (Alexandratos & Bruinsma 2012). These developments are likely to negatively affect wildlife including leopard populations (Stein et al. 2016). In forested Africa, deforestation has been identified as a significant threat to leopards (Ikemeh 2007).

In Uganda increase in livestock farms and crop cultivation enhance natural habitat loss and fragmentation (CITES 2007a, e). In Tanzania habitat loss and agricultural conversion are also thought to have adversely affected leopards, including changing migratory patterns of wildlife in the Serengeti and Tarangire ecosystems, affecting also resident carnivore populations (Maddox 2003). In Zambia, uncontrolled burning, slash and burn farming systems and sometimes informal mining are threatening leopards in NPs and in GMAs, human encroachment, deforestation, and subsistence agriculture additional lead to habitat loss (Simasiku et al. 2008, Lindsey et al. 2014). In Zimbabwe, much of the leopard's range has disappeared due to the resettlement of private farmland and the subsequent loss of prey populations (du Toit 2004).

## Prey depletion

The leopard's persistence (in human-altered habitats) relies highly on the availability of prey (Jorge 2012). Thus, the loss of prey impacts leopard populations and can be an important driver of population declines (Henschel 2008), even in otherwise prime habitat. In Africa, natural prey species of the leopard (mainly medium sized ungulates) are widely hunted by humans for the bushmeat trade (Jorge 2012, Stein et al. 2016). Data on herbivore populations in 78 PAs in western, eastern and southern Africa monitored from 1970 to 2005 revealed an over-all 59% decline in population abundance. However, while herbivore populations increased by 24% in southern Africa, they declined by 52% in East Africa and by 85% in West Africa during the study period (Craigie et al. 2010). Indications show that bushmeat is increasingly commercial in many areas due to the increased human population, leading to an increased demand for bushmeat, too (Lindsey et al. 2015). In several places in West and Central Africa the "empty forest syndrome" can be observed, where forest habitats are still intact, but prey species have been nearly wiped out by overhunting (Henschel 2008, Olupot et al. 2009, Hunter & Barrett 2011). In African rainforests, leopards seem to exhibit a strong functional and numerical response to competition with human hunters for prey as there is a high dietary overlap between human hunters and leopards. Consequently, leopard populations are smaller or absent close to settlements where hunting pressure on prey is high (Henschel 2008, 2001, Willcox 2002). In Gabon, bushmeat hunting was strongly correlated with leopard disappearance (Henschel 2008, 2009). The bushmeat market in the Congo Basin is thought to have had an important negative effect on leopard populations and may have led to local extinctions (Henschel 2009). Leopards are already absent from the rainforest in Cameroon, where bushmeat extraction is high (Toni & Lodé 2013). In the rainforests of the Congo Basin, species are unsustainably hunted due to an increasing demand for bushmeat, which is often the major protein source of people in rural areas. Bushmeat trade in the Republic of the Congo has been found to have a serious effect on ungulate populations in PAs (Henschel 2008, Wilkie & Carpenter 1999). South of the Uele River (DRC) a massive unregulated commerce in bushmeat was recorded and hundreds of snares detected (Hicks 2010).

Also in the savannas of Africa, important leopard prey, are under threat from an unsustainable bushmeat trade leading to a collapse of prey populations (Lindsey et al. 2013b). The demand for bushmeat and other wildlife products in savanna Africa is expected to increase even more in future (Lindsey et al. 2013b). In Zambia wild animal populations have been reduced in 70% of all GMAs due

to bushmeat hunting. According to Lindsey et al (2014), *“observed biomasses of large mammals in Zambian protected areas were lower than potential maximum carrying capacities by 93.7% in GMAs and 74.1% in NPs”*. In Mozambique, bushmeat poaching has severely reduced leopard prey and also affected leopards directly as they got caught in the snares set for the other species – both inside and even more outside PAs (Becker et al. 2013, Hatton et al. 2001, Fusari & Carpaneto 2006, NCP 2013). In the Okomu Forest Reserve in Nigeria, hunting pressure on prey species is thought to be the most important threat to leopard (Ikemeh 2007). In the Limpopo NP in South Africa, increased bushmeat hunting could negatively affect leopards too due to competition with humans for prey, forcing leopards to seek prey increasing outside the PA, where they get in conflict with humans (Strampelli 2015). In Tanzania, overexploitation of ungulates through tourist hunting was found threatening leopard prey species (Caro et al. 1998).

The context of prey depletion is however complex, concluded by Lindsey et al. (2015): *“increasing demand for bushmeat in rural and urban areas, human encroachment into wildlife areas, inadequate penal systems and lack of enforcement, missing alternative livelihoods and food sources, lack of clear rights over wildlife or land, and/or inadequate benefits from wildlife, political instability, corruption and poor governance, demand for wildlife body parts for traditional medicine and ceremonies and abundant supplies of wire [i.e. due to increased fencing and installation of cables for telephone and electricity, wire became more abundant and got often stolen for building snares]”*. Accordingly, the long-term solution for the problem of reduced prey availability for leopard will have to be a variety of measures at several levels.

## Conflict

Human-leopard conflicts due to leopard predation on livestock and resulting retaliation killing are widespread across the continent. Persecution of leopards by humans has demographic consequences and poses a threat to the sustainability of leopard populations (Swanepoel et al. 2014, 2015).

Retaliation killing due to livestock predation is considered a major threat to leopards in eastern and southern Africa and to a lesser extent in West and Central Africa. In several countries of Sub-Saharan Africa where predators are considered a threat to life and property, the killing of predators in protection for life or property is legal and permits can even be obtained retroactively (Lemeris 2013, Boast 2014, Constant 2014, Stein et al. 2016). But many leopards killed due to livestock or game predation stay unrecorded, and the extent of mortality due to persecution and conflict remains unknown (Stein et al. 2016).

In Bale Mountains NP in Ethiopia, carnivores (including leopards) are killed due to livestock predation (Atickem et al. 2010). Retaliation killing of leopards due to predation has also been reported in Uganda (Olupot et al. 2009) and is the main conflict with leopards in the Zambezi Basin (Purchase et al. 2007). Livestock predation by leopards leading to illegal killing of the predator occurs in Mozambique (Annex 1, CITES 2018b), north-western Zimbabwe (Loverdige et al. 2017) and Zambia (Purchase et al. 2007). Many leopards are poisoned or speared in retaliation to livestock predation in Kenya and Tanzania (Jorge 2012, Kuloba 2012, Jacobson et al. 2016). In Botswana and Namibia, human-leopard conflicts are an issue, leopards are perceived as problem animals in many areas and retaliatory killing frequently takes place (Purchase et al. 2007, Kent 2011, Boast 2014, Scheiss-Meier et al. 2007, Stein 2008). In Nyika NP in Malawi, leopards are in conflict with humans due to livestock depredation and threats to human life (Purchase et al. 2007). Across South Africa, livestock predation by leopards is

the major cause of conflict, and the retaliation killing of leopards is high (Chase-Grey et al. 2007, Swanepoel 2008, Swanepoel et al. 2014). Persecution of leopards by farmers and game rangers has been reported from the Cape Province (Hargreaves 2010, Msuha 2009), KwaZulu-Natal (Balme & Hunter 2004, Balme et al. 2010b) and Limpopo Province (Chase-Grey 2011). In the Soutpansberg Mountains, Limpopo Province, the leopard density has declined by 44% since 2012 and by 66% since 2008. Leopard mortality was supposed to be primarily caused by illegal human activity (retaliation for livestock predation and bushmeat hunting; Williams et al. 2017). If this decline continues, the leopard population from Soutpansberg Mountains will be extinct before 2020 (Williams et al. 2017). Human-wildlife conflict is also an issue in Central Africa: In Upemba NP in the Democratic Republic of the Congo, depredated livestock was poisoned to combat carnivores (Vanleeuwe et al. 2009). In West Africa, from Senegal to Cameroon, herders were found the main group responsible for poisoning carcasses in retaliation for livestock predation (Croes et al. 2008, P. Henschel, pers. comm.).

Human-leopard conflict due to leopards preying on game animals is an important topic only in southern Africa (G. Balme pers. comm., Boast 2014). Game farms often have high densities of wild ungulates for the purposes of (trophy) hunting, consumptive use, live sales and ecotourism (Hunter & Balme n.d., Lindsey et al. 2009, Van der Waal & Dekker 2000). Especially in parts of South Africa, predation of leopards on game is one of the major causes of human-leopard conflict, and leopards were highly persecuted (Swanepoel 2008). The conflict has increased even more when the ranching industry begun breeding high-value game species or colour morphs (Thorn et al. 2013). In some regions, wildlife authorities grant permits to concerned landowners for the removal of confirmed damage-causing leopards, but there is a risk to eliminate non-problem leopards (Balme et al. 2009).

## Trophy hunting

Leopard trophy hunting is currently carried out in the following countries: Central African Republic, the Democratic Republic of the Congo, Ethiopia, Malawi, Mozambique, Namibia, Uganda (only problem animals), Tanzania, Zambia and Zimbabwe (Braczkowski et al. 2015). In Botswana, Kenya and South Africa a ban on leopard hunting is in place since 2013, 1977 and 2016 respectively (Table 2.3.2). Gabon does not have a CITES leopard export quota since 2008 (Table 2.3.1). At the CITES AC30 meeting in July 2018, Malawi and Kenya have expressed wish for their CITES quotas to be removed from Resolution Conf. 10.14 (Rev. CoP16; see [SC70 Doc. 55](#)).

Trophy hunting has the potential to be a conservation tool, positively affecting wildlife populations as well as human communities, for example by protection of habitat for game species and generation of substantial revenue which can be invested in conservation activities (Balme et al. 2010b, IUCN SSC 2012a). According to Di Minin et al. (2015), "*sustainable hunting can create important incentives for biodiversity conservation in areas where ecotourism is not economically viable*". If the hunting of predators such as the leopard helps enhancing human livelihoods, they may be tolerated by local communities to a greater extent. For trophy hunting to be beneficial to conservation, it needs to be sustainable, scientifically-based, well-managed, non-detrimental to the population, and when local communities get economic benefits compensating for the costs for living alongside large carnivores (Balme et al. 2010b, Chase-Grey 2011, IUCN SSC 2012a, Leader-Williams & Hutton 2005). Namibia is such a case where trophy hunting has generally been shown to directly benefit wildlife conservation (G. Balme, pers. comm.), because the revenue from trophy hunting has encouraged local communities to participate in conservation. This led to an increase in the abundance of wildlife species and to

an increase in the total land area under community protection through conservancies (Lindsey et al. 2007, Di Minin et al. 2015).

Sustainable hunting of large carnivores is generally a challenge because (1) such species live at low densities (compared to other game species) and viable populations require very large spaces, and (2) the characteristic land tenure and social system of large cats entails that the recruitment is sensitive to changes in the population structure. This is especially the case if a population is low, e.g. due to reduced prey availability, what is the case for many leopard populations. There were a number of concerns raised with regard to the impact of trophy hunting on leopard populations (e.g. Balme et al. 2010b, Pitman 2012, Brackowski et al. 2015). Purchase et al. (2007) feared that trophy hunting levels within the Zambezi Basin had a long-term negative effect on the population viability of leopard populations. In the Luangwa Valley, Zambia, trophy hunting was shown to have a negative impact on leopards, posing a high pressure on the species (Ray 2011). In the Mangwe area, Zimbabwe, trophy hunting quotas were assessed as unsustainable (Grant 2012). In Tanzania, leopard declines have been linked to unsustainable trophy hunting quotas (Boast 2014). In the Niassa NR in Mozambique, the leopard trophy hunting quota was thought to be unsustainable, given the additional high levels of illegal killing (NCP 2012, 2014). In South Africa, over-harvesting and inadequate allocation of hunting permits) were identified as the reason for predicted population decreases (Balme et al. 2010b, Williams et al. 2017). Recent research indicated that leopard hunting quotas in Limpopo, which accounted for >60% of leopard trophies hunted in South Africa, were unsustainable, especially if the removed damage causing animals were included ([Annex 3](#), CITES 2018b). Such findings lead to a temporary ban of leopard trophy hunting in 2016, and a very prudent allocation of permits nowadays.

Compensation from trophy hunting rarely finds its way to households and thus leopards are also poached to increase local incomes (G. Balme, pers. comm., Jorge et al. 2013, Palazy et al. 2011).

Balme et al. (2010b) argued that trophy hunting, if not well managed, can negatively affect the viability of leopard populations and even lead to local extinctions. Inadequate trophy hunting can reduce the genetic diversity by targeting always the fittest (e.g. the largest) individuals by hunters (Balme et al. 2010b, Brackowski et al. 2015). Moreover, hunting can impact demographic patterns and the social organisation of leopard populations (Balme et al. 2010b, Kerth et al. 2013, Pitman 2012, Stein et al. 2016). Where leopards have been persecuted, reduced reproductive success and cub survival compared to populations living in PAs was recorded (Stein 2008). A high removal of (resident) male leopards can lead to a high turnover of males and consequently to increasing infanticide. In extremis, this can lead to females failing to raise young due to frequent incursions of new males (Balme et al. 2009, Packer et al. 2009, Balme 2010). Trophy hunting of under-aged leopards (<4 years) was thought to negatively impact leopard populations (NCP 2012). Stein et al. (2016) argued that the removal of leopards through trophy hunting was often not compensatory but additive to other causes of mortality.

In many countries where leopard trophy hunting is performed, robust (scientific) data on the conservation status of local leopard populations is low. Hunting quotas and number of licenses issued are therefore generally not determined based on accurate estimates of population size, trend and status (Balme et al. 2010b, Strampelli 2015). Information on the size and trend of the population must be known to accurately set quotas for trophy hunting (Zeiss 1998). Moreover, the “conservation status” (e.g. population structure, recruitment, turn-over) should be known to define adequate management interventions including off-take. As long as the dynamics of removing animals and repercussions at

the population level are not completely understood, the impact of trophy hunting on local leopard populations is of concern (Lindsey et al. 2009). As revealed through the non-detriment finding reports submitted by most African Parties to CITES performing leopard trophy hunting (based on CITES CoP17 Decision 17.114), most countries today issue a number of leopard licenses per year that is considerably lower than the export quota (Table 2.3.1), taking into consideration the unfavourable conservation status of many leopard populations.

## Illegal killing

Illegal snaring of wildlife, mainly for bushmeat hunting, is rampant, particularly in West and Central Africa (P. Henschel, pers. comm.), but is also an issue in the southern part of the continent. Snaring is an unselective method; both predator and prey species are indiscriminately captured. This has the potential to lead to a collapse of the prey base but is also a direct threat to leopards as they occasionally get caught in snares set for other species. In Gabon, leopards were killed by illegally set snares for capturing other species for the bushmeat trade (Henschel 2008, 2009). In the Cape Province, South Africa, leopards are incidentally killed in snares (Hargreaves 2010). Bushmeat snaring is considered to be the most significant threat to large carnivores in Niassa NR, Mozambique (NCP 2014). The impact of snaring on leopard populations has not yet been quantified, but has the potential to impact habitat suitability and connectivity value for leopards (Fattebert et al. 2013).

Besides accidental killing, leopards are also directly poached for the wildlife trade as their skins are very popular and their bones are used as substitutes for tiger parts in Traditional Chinese Medicine (Hunter & Barrett 2011, Raza et al. 2012). Seizures of leopards were similar to those of tigers in many Asian range States, and outside Asia in terms of derivative seizures (Nowell & Pervushina 2014). Leopards are considered to be the most traded big cat in Asia. Since 2000, 5,030 leopards (likely representing a fraction of what is actually traded) have been seized from illegal trade in Asia. One driver to the trade in leopard bones is the demand for leopard bone to be in Traditional Chinese Medicine (EIA 2018). Traders have occasionally claimed that leopard skins appearing in the “Golden Triangle Special Economic Zone” of Lao PDR’s Bokeo Province, from where they are sold mainly to China, have been sourced from Africa (EIA 2011a, b, 2015).

The killing of leopards for their skins, canines and claws is mainly a problem in West, Central and southern Africa (Hunter & Barrett 2011). Leopard skins and body parts are believed to give strength to the people who wear them as a part of traditional medicine beliefs in Africa. Skins are still traded in many areas and are openly sold in cities and villages (Constant 2014, Stein et al. 2016). Illegal leopard hunting for the wildlife trade and/or trading of leopard skins has been reported from Benin, the Republic of the Congo, the Democratic Republic of the Congo, Gabon, Zimbabwe, and Uganda (Henschel & Ray 2003, Hicks 2010, African parks 2011, Gandiwa 2011, Matho 2011, Di Silvestre & Bauer 2013, Olupot et al. 2009, Obank et al. 2015). In 2013, leopard skins appeared in markets in Morocco, where the species is considered extinct. Thus, the skins must have been old or coming from other regions (Bergin & Nijam 2014). In South Africa, killing of leopards for the international or national trade is a major problem in some areas (Lindsey et al. 2011b). In the whole of southern Africa, leopards are excessively harvested for their skins which are used in ceremonies and for cultural purposes (Stein et al. 2016). Around 4,500–7,000 leopards were estimated to be killed and traded illegally each year in (southern) Africa to meet the demands for skins by followers of the Nazareth Baptist Shembe Church alone (Lindsey et al. 2015, Balme et al. 2013, G. Balme, unpubl. data). It is suggested that there are around 13,000 and 18,000 illegal leopard skins in circulation among members of the



church. Also leopard skins originating from Mozambique appear in this market of skins ([Annex 1](#) & Annex 2 AC30 Doc. 15, CITES 2018b).

Illegal killing of leopards in Mozambique (especially for the illegal skin trade) appears to be driven not only by retaliation, but also by the economic value of leopard skins (Jorge 2012, NCP 2012). Some local people in Niassa NR poach leopards to increase their income, as poaching creates higher benefits for them than legal trophy hunting (NCP 2014). Illegal hunting of leopards per 100 km<sup>2</sup> and year was assessed to be five times higher than the mean trophy hunting intensity for leopards per 100 km<sup>2</sup> per year (Jorge 2012, NCP 2014). Consequently, maintaining a commercial value of leopards and assure that local people get an adequate share of these revenues is crucial for the conservation of the leopard.

## 2.5 Monitoring, research and conservation

Methodological approach, efforts and available publications and reports on monitoring, research and conservation activities vary strongly depending on the country.

### Surveys and monitoring

Robust monitoring of leopard populations is so far mostly local (e.g. restricted to study areas, most often in PAs or parts of PAs or GMAs) and mostly refined to scientific conservation projects. There is no consensus on “correct” leopard monitoring or any recommendation for a standardised approach, but in recent years, camera trapping has – as for other individually distinct solitary terrestrial mammals – been demonstrated the best way to produce reliable data on leopards. South Africa applies an intensive monitoring using systematic camera trap surveys every year at 20 strategic sites across the country, in order to produce a robust estimate on leopard population density by means of spatial capture-recapture sampling. This method is combined with an extensive monitoring including relative abundance indices, generated by occupancy estimation, catch-per-unit effort and changes in harvest composition (CITES 2018f, Mann et al. 2018). In South Africa, norms and standards for leopard trophy hunting are under development to create a national management plan providing standardized management guidelines ([Annex 3](#), CITES 2018b). The Zambian Department of National Parks & Wildlife intends to set up a very similar system for Zambia as applied in South Africa ([Annex 5](#) AC30 Doc. 15, CITES 2018b). Also in Mozambique, monitoring frameworks are developed to reliably assess leopard population trends at a national scale ([Annex 1](#), CITES 2018b). In Namibia, leopards were monitored in the frame of the National Carnivore Monitoring Programme (LCMAN no date) and information on their status and distribution is continuously collected for the Namibia Large Carnivore Atlas which is updated every six month (Hanssen & Stander 2003, 2004). In the National Leopard Survey in Namibia, Stein et al. (2012) used a combination of questionnaires, camera-trapping, spoor tracking and evidence of leopard presence provided by multiple stakeholders. A follow-up leopard survey is conducted (expected to be finished in 2019). This survey uses, “*a multi-disciplinary approach, inside and outside national parks, by combining ecological methodologies and social science to understand the pressures on, and status of, the leopard population across Namibia*”. The Tanzania Wildlife Research Institute will conduct nationwide leopard and lion surveys in 2018-2019 ([Annex 4](#), CITES 2018b). In Zimbabwe, the Zimbabwe Parks and Wildlife Management Authority, the Wildlife Conservation Research Unit of Oxford University and the Zambezi Society assessed the national leopard population from 2009–2012. A “*monitoring framework for leopards in Zimbabwe that combines*

*rigorous estimates of leopard population densities from camera-trap surveys undertaken annually at key sites with broader-scale estimates of leopard occupancy derived from track count at the same sites” is proposed (Panthera & ZPWMA 2018). Such a framework will allow identifying and responding to changes in leopard populations (Panthera & ZPWMA 2018). The Zimbabwe Parks and Wildlife Management Authority together with Zimbabwe Professional Hunting Guides Association and Safari Operators Association of Zimbabwe “has put in motion an action plan to cover the known range of leopard in Zimbabwe using hard ground work in the form of spoor transects, independent data submissions in the form of trail cam pictures, historic quota and off-take trends and scientific interpretation of these” (Annex 6 AC30 Doc. 15, CITES 2018b).*

Consistent monitoring across the leopard’s distribution range is crucial for a realistic assessment of the population status. Simplistic extrapolation of densities from monitoring plots (e.g. by means of habitat models) risk to result in an overestimation of the total abundance as the study areas are generally in the best areas, e.g. in PAs. In Gabon Panthera (2018a) launched a project to monitor leopards roaming between PAs. For leopard range countries with very limited information on leopards, an initial survey to set the baseline for subsequent monitoring would be needed, but we found no information on such baseline surveys.

## Research and conservation

Conservation and research priorities in the light of key factors and related principles for the conservation of larger African carnivores, including the leopard, were reviewed by Ray et al. (2005) and Winterbach et al. (2013). In 2012, Lindsey et al. (2015) studied drivers and impacts of illegal hunting and bushmeat trade in Savanna Africa and proposed possible solutions (Chapter 2.4). As another over-arching issue, a study looking at the phylogenetic traits of leopards across Africa was started (P. Henschel, pers. comm.).

The majority of scientific publications referred to in this Roadmap come from the southern distribution areas of the species in Africa. But generally, little research on the leopard (compared to other large cats) has been carried out, especially in Central, East and West Africa. Between 2000 and 2015 most work on the African leopard took place in southern Africa (South Africa, Namibia, Botswana, Zimbabwe, Zambia, Tanzania, Mozambique; Jacobson et al. 2016). Research projects were primarily concentrating on a local population, carried out in one or several PAs or GMAs, often focusing on few animals. Studies at the scale of entire population including areas outside PAs are scarce and only very few projects at regional or international scale exist.

### *West Africa*

Few leopard research projects were so far conducted in West Africa. Jenny (1996) studied leopard by means of radio-telemetry in the Taï NP (Ivory Coast). The ‘Large Carnivore Initiative for West- and Central Africa’ has addressed human-carnivore conflicts mitigation, strengthening of the large carnivore network, awareness raising and enhanced exchange of information has been addressed in West and Central Africa (Leo Foundation no date). In the W-Arly-Pendjari Complex (WAP), spoor surveys were conducted to study large carnivore presence including leopard (Jacobson et al. 2016). Leopard surveys were done in Burkina Faso (Médard et al. 2010), in parts of Guinea-Bissau and Guinea (Brugière et al. 2005), a preliminary assessment of the leopard’s status was conducted in Okomu Forest Reserve, Nigeria (Ikemeh 2007), and leopard occupancy, density and population size were studied in Senegal in Nikolo-Koba NP (Kane 2014).

### *Central Africa*

Recent leopard-focused projects have only taken place in Cameroon, Equatorial Guinea and Gabon. The status of the leopard, threats, distribution, density and diet has been addressed (Henschel 2008, Henschel et al. 2011, Martinez Marti 2011, Toni & Iode 2013). A project assessing the leopard's status is taking place in Gabon (Panthera 2018a). In Cameroon, Central African Republic, Republic of the Congo and Gabon, few projects providing some information on leopard presence were conducted (Boulet et al. 2008, Melletti et al. 2009, Croes et al. 2011, Toni & Lodé 2013, Henschel et al. 2005, 2011, 2014, TEAM Network no date). In the Democratic Republic of the Congo, a project has been ongoing since 2015 to study corridors between NPs using the leopard as a focal species (P. Henschel pers. comm.).

### *Southern Africa*

More (research) projects with a focus on leopard have been undertaken in southern Africa compared to the other regions. Projects including leopards were taking place in Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Zambia and Zimbabwe. Main topics recently addressed included space use, home range size, movement patterns and activity as well as diet, population density, monitoring, human-leopard conflict, trophy hunting issues and awareness raising (e.g. Schiess-Meier et al. 2007, Balme et al. 2009, 2010b, Chapman & Balme 2010, Chase-Grey et al. 2013, Lindsey et al. 2013a, Loveridge 2009, Martins & Harris 2013, Ray 2011, African Wildlife Foundation n.d., Kgalagadi Leopard Project n.d., LCMAN n.d., Leopard Conservation Project n.d., N/a'a ku sê Conservation through Innovation n.d., Panthera 2018a, b, 2016, The Africat foundation n.d., Zambian Carnivore Programme 2015, Annex I, CITES 2018b).

Conflict mitigation strategies to increase farmers' tolerance of leopards have been applied in various regions of southern Africa including the improvement of livestock husbandry, compensation/insurance methods, changes in trophy hunting permit distribution and improvement of public awareness (Stein et al. 2016). Leopard trophy hunting was examined in Namibia in 2010, regional studies of the hunting quota system were conducted in South Africa, Mozambique and Botswana to assess the sustainability of the hunting (Stein et al. 2016). Criteria such as extent of facial scarring, ear condition, nose colour and dewlap size can be helpful to age leopards in the field (Balme et al. 2012b).

### *East Africa*

Only few studies collecting data pertaining to leopards have been carried out recently. In Djibouti, a workshop on the conservation of priority land animals, including leopards, took place in 2012 (Holst et al. 2013). In Ethiopia, human-carnivore conflicts have been addressed in several areas (Yihune et al. 2009, Yirga & Bauer 2011). In Kenya, human-carnivore conflict has been studied as well as the diet, density and movement patterns of leopards in some PAs (Kenya Wildlife Service 2012, O'Brien & Kinnaird 2011, Okello et al. 2014a,b, Svengren & Bjoerklund 2010). In Tanzania, human-carnivore conflict, leopard home range size and effects of trophy hunting on leopard populations have been studied and a conservation action plan produced (Caso 2002, Dickman et al. 2014, Holmern et al. 2007, Packer et al. 2011, TAWIRI 2009). In Uganda, a strategic action plan for carnivore conservation was developed in 2010 (UWA 2010).

## 2.6 Gaps in knowledge and conservation challenges

Current population status assessments, strategic conservation plans and National Action Plans are rare for leopard in Africa (Table 2.6.1). Continent-wide reviews of the status of the leopard date back to the 1970s or 1980s. No range-wide nor any Regional Conservation Strategy for the leopard exists, and we found only two National Action Plans, one from Tanzania developed in 2009 (targeted at lions and leopards; TAWIRI 2009) and one from Uganda focussing on large carnivores (UWA 2010; Table 2.6.1). Namibia is in the process of developing a leopard management plan based on the currently conducted national leopard survey, expected to be finished in 2019 ([Annex 2](#), CITES 2018b). A conservation initiative as for lion, cheetah, and African wild dog is still missing for the leopard. More targeted efforts and transboundary cooperation are needed to advance the conservation of *Panthera pardus*.

The most obvious knowledge gaps are in West, Central and East Africa, where little leopard-focused research has been carried out. However, there is a general need for more country-wide and leopard-focused surveys and research (especially outside of PAs) to assess the population distribution, status and trend in southern Africa. Even for leopards in South Africa, where most leopard work was conducted, many questions on the status of the population (abundance, population trend, recruitment) as well as about management issues (illegal off-take, management history, quotas) were not sufficiently known some years ago (Lindsey et al. 2011a). Recent efforts to improve the monitoring have shed light on some of the most urgent question, and the general findings were that the status of local leopard populations was not as good as thought (REF BALME). Moreover, there is an need for more transboundary surveys and conservation efforts across Africa.

The impacts of threats (i.e. wildlife trade, bushmeat hunting and poaching) are not yet fully understood but are potentially severe, and need investigations. Conflict mitigation strategies for human-leopard conflicts (mainly due to livestock and game predation) have been developed in some places, but are not currently enough to assure the leopard's long-term survival (Stein et al. 2016). Thus, further mitigation measures should be researched and applied. Moreover, the connectivity between leopard populations should be researched and enhanced. In many parts of the leopard's range, there is a lack of awareness about or importance of the species and there is a need to increase awareness of the leopard and its importance as well as knowledge and understanding of its role in the ecosystems.

In any of the range countries, except in South Africa (and possibly Namibia and Gabon), a country-wide leopard monitoring framework is in place (Chapter 2.5).

Lack of enforcement for existing laws and policies protecting the leopard is a problem too. In addition, in many areas, enforcement officers lack training to recognise protected species and illegal wildlife parts and therefore are not capable to actively fight illegal wildlife trade (Obank et al. 2015). Additionally, the lack of local capacity and resources for different levels of government within countries has been identified as one of the major constraints for the implementation of conservation actions. Only if existing legislation and international agreements are effectively implemented and if the needed resources and capacities are available, they can positively contribute to conservation efforts (Abensperg-Traun 2009). Long-term survival of the leopard in the Congo Basin e.g. will highly depend on regulations of excessive and unsustainable bushmeat harvesting practices (Henschel et al. 2011). However, legal protection of the leopard alone is not sufficient, if the ecological conditions are inadequate.

**Table 2.6.1.** Status assessments, Regional Strategies, National Action Plans, documents outlining conservation measures developed specifically for the leopard, and documents produced for other species considered being beneficial for leopard conservation.

Region	Document
<b>Africa</b>	Setting conservation and research priorities for larger African carnivores 2005 (Ray et al. 2005)
<b>Sub-Saharan Africa</b>	The leopard <i>Panthera pardus</i> in Africa 1976 (Myers 1976) Status and conservation of leopards in Sub-Saharan Africa 1977 (Eaton 1977) The Status of Leopard in Sub-Saharan Africa (Martin & de Meulenaer 1988)
<b>Eastern Africa</b>	Regional conservation strategy for the conservation of Cheetah and African wild dog in Eastern Africa 2007 (IUCN/SSC 2007)
<b>Ethiopia</b>	National Action Plan for the conservation of Cheetahs and African wild dogs in Ethiopia 2012 (EWCA 2012)
<b>Liberia</b>	Large mammal distribution in Liberia 1991 (Anstey 1991)
<b>Mozambique</b>	Review of the Leopard ( <i>Panthera pardus</i> ) quota of Mozambique, established per Resolution Conf. 10.14 (Rev. CoP16) and non-detriment determinations, in accordance with CITES Decision 17.114 ( <a href="#">Annex 1</a> AC30 Doc. 15)
<b>Namibia</b>	Interpretation and implementation of the Convention - Regular and special reports - Appendix-I species subject to export quotas – Leopard - Export Quota Review – Namibia ( <a href="#">Annex 2</a> AC30 Doc. 15)
<b>Somalia</b>	Status of large mammals in Somalia 1985 (Fagotto 1985)
<b>South Africa</b>	Conservation plan for the Cape Mountain leopard population 1986 (Norton 1986) Threatened status for the leopards in South Africa 1981 (Arnett 1981) Leopard <i>Panthera pardus</i> population and habitat viability assessment 2005 (Daly et al. 2005). Non-Detriment Finding Assessment for the trophy hunting of leopards in South Africa (Lindsey et al. 2011a). Leopard Quota Review: South Africa ( <a href="#">Annex 3</a> AC30 Doc. 15)
<b>South Sudan</b>	National Action Plan for the conservation of Cheetahs and African wild dogs in South Sudan 2010 (South Sudan Wildlife Service 2010)
<b>Tanzania</b>	The Tanzania Lion and Leopard Conservation Action Plan (TAWIRI 2009) Report on Decision 17.114 regarding African leopard ( <i>Panthera pardus</i> ) quotas established under Resolution Conf. 10.14 (Rev. CoP16) ( <a href="#">Annex 4</a> AC30 Doc. 15)
<b>Uganda</b>	Strategic Action Plan for large Carnivore Conservation in Uganda (UWA 2010)
<b>Zambia</b>	Non detrimental findings report for African leopard sport hunting in Zambia ( <a href="#">Annex 5</a> AC30 Doc. 15).
<b>Zimbabwe</b>	Zimbabwe's review of the convention on international trade in endangered species (CITES) leopard ( <i>Panthera pardus</i> ) quota ( <a href="#">Annex 6</a> AC30 Doc. 15)

### 3. Recommendations

The long-term conservation of the leopard *Panthera pardus* needs more attention and more means at global, regional and national level, both from governmental institutions and from private institutions dealing with wildlife conservation or research. While all other large cats such as lions, cheetahs, tigers or snow leopard have been in the focus of conservation organisations for a long time, the leopard was neglected and leopard conservation activities under-funded. The joint [CITES-CMS African Carnivore Initiative](#) offers the opportunity to advance leopard conservation in the years to come. Many of the shortcomings and gaps mentioned in Chapter 2.6 can be addressed for all species considered under the ACI together (e.g. capacity development), but others will have to be tackled in projects specifically for the leopard.

#### Strategic planning for leopard conservation

Conserving species such as the leopard, who requires huge spaces for maintaining viable populations and is often in conflict with people sharing the same living space, is a particular challenge. For the outline of a possible approach following hereafter, we refer to the IUCN recommendations for the strategic planning in species conservation as outlined in IUCN – SSC Species Conservation Planning Sub-Committee (2017) and Breitenmoser et al. 2015) and use the principle IUCN approach of “Assess – Plan – Act” (IUCN SSC 2017; Fig. 3.1.1).



Fig. 3.1.1. IUCN’s Assess-Plan-Act cycle (IUCN SSC 2017). KSR are Key Species Results as defined by the Species Survival Commission.

ASSESS includes the thorough analysis of the situation, e.g. the conservation status of the species in the area of interest, but also the identification of key stakeholders, potential actors and partners, and the capacities available.

PLAN incorporates the strategic planning at range-wide or regional, in the case of large cats most often at transboundary level, but also the development of more concrete implementation plans, e.g. in form of National Action Plans.

ACT is the phase of the implementation of the Strategy and the NAPs, accompanied by a robust monitoring of the effects of the interventions. This includes most often a general monitoring of the populations affected, but may need more specific measuring of indicators defined for certain results. As long as the over-all goal of a conservation strategy is not reached, the continuous or periodic monitoring and evaluation will lead to a review and if needed adaptation of the plan in order to make it more effective. The “strategic planning cycle” (Breitenmoser et al. 2015) hence describes an adaptive process.

For the species included in the ACI, this strategic planning approach has been partly implemented. Regional strategies (IUCN SSC Cat Specialist Group 2006a, b) were developed in 2006 for the lion, and subsequently several National Action Plans (see overview in IUCN SSC Cat Specialist Group 2018). For cheetahs and African wild dogs, three Regional Conservation Strategies (RCS) were developed for southern (IUCN-SSC 2015), eastern (IUCN-SSC 2007) and western, central and northern Africa (IUCN-SSC 2012b). The RCS for southern Africa was originally developed in a participatory workshop in 2007, and reviewed and revised in 2015. The RCS are implemented through NAPs, and the implementation is facilitated by regional coordinators for each of the RCS (IUCN SSC Cat Specialist Group 2018).

## Steps towards a leopard conservation programme

A strategic planning process for the conservation of the leopard in Africa will be able to profit from the work done for the other three species in the ACI, as the key national institutions, the international players, the organisational structures as well as the conservation challenges and solutions will be the same or at least broadly overlap. What however is needed is more detailed leopard-specific information, and in this respect, the leopard is lagging behind the other ACI species. We propose the following steps to be taken towards a comprehensive conservation programme for *Panthera pardus* in Africa:

*1. Setting the context and reviewing the state of knowledge:* This *Roadmap* can serve as a first review of the situation of the leopard in Africa. However, our review has revealed considerable gaps with regard to detailed information from many Range Countries. We suggest taking the information provided in the *Roadmap* as a starting point, but to produce more detailed *Status Reviews* for each of the four proposed Conservation Units. This Review should be done by means of a standardised approach including national institution and experts familiar with the leopard/wildlife in the respective country.

*2. Develop Regional Conservation Strategies and (National) Action Plans:* As for lion, cheetah and African wild dog, RCS should then be developed in order to guide the development of more specific NAPs, according to the Guidelines for Species Conservation Planning (IUCN-SSC Species Conservation Planning Sub-Committee 2017). An RCS would define the Goal, Objectives (see below), Results, and Actions at regional level. The NAPs would then concretise the Objectives and Results valid for the respective country, and define the Actions, actors, and time-frame at national level. The RCS should take into consideration the metapopulation structure of transboundary leopard population as identified in Step 1. Depending on the spatial structure, the strategic and action planning could be united in one Conservation Plan for such a leopard metapopulation. But as the concrete implementation of actions is most often very country-specific, NAPs are generally the most practical way for implementing actions.

3. *Implement conservation actions and monitor the effect on leopard populations:* Conservation measures as defined in the RCS and NAPs are then implemented according to the time plan defined in the plans. A monitoring concept to observe the effects of the interventions is implemented parallel to the action plans. The implementation phase requires a good organisational structure, including a clear communication, exchange of information and sharing experiences. The [Range Wide Conservation Programme for Cheetah and African Wild dogs](#) made good experiences with regional and national coordinators who are closely working together and facilitate the implementation of the RCS and NAPs.

4. *Review RCS and NAPs and adapt the conservation activities:* Regular reporting and meetings are organised to track the progress and to make adaptations wherever needed. Most strategies and plans, when developed first, are setting too ambitious Objectives and Results in a too tight time frame. Therefore, an adaptive process, informed by a good monitoring and good reporting, is highly recommended.

## Preliminary Objectives and Actions for a leopard conservation programme

The unlike status of the leopard populations in the four regions (Fig. 4) suggests that the goals might be different for each conservation unit (Fig. 5). In southern and East Africa, further decline must be halted and the leopard population must be strengthened to avoid further fragmentation. In West Africa, conserving the remnant nuclei alone will likely not be sufficient to maintain the leopard. The populations are too small and too isolated to be long-term viable. Here, lost ground must be regained in order to re-connect these small populations. Central Africa is probably in-between, but the information on the status of the leopard populations in this conservation unit is so limited that surveys must be the first priority.

The following preliminary Objectives and Actions should be considered for a leopard conservation programme:

**Objective 1. Strategic planning** for leopard conservation at the range-wide, regional and national level: To develop, in a participatory process, a range-wide conservation plan (e.g. this *Roadmap*), Regional Conservation Strategies and National Action Plans for the implementation of conservation measures.

*Action 1.1.* Develop a range-wide conservation plan (this *Roadmap*) for leopard as a guiding document for regional and national planning.

*Action 1.2.* Develop in a participatory approach Regional Conservation Strategies for the leopard and National Action Plans as implementation tools.

**Objective 2. Baseline surveys:** To survey and assess, for leopard regions with low level of knowledge, conservation status of leopards and their prey, threats, human attitudes and enabling conditions.

*Action 2.1.* Develop best practice standards for baseline surveys for leopard conservation and a standardise list of topics to be compiled (e.g. by means of a questionnaire).

*Action 2.2.* Identify priority areas with low level of knowledge and high conservation value for leopards that warrants urgent baseline survey.

*Action 2.3.* Undertake the baseline surveys in the selected areas according to the defined standards in cooperation with the respective Range Country.



**Objective 3. Monitoring:** To establish a long-term monitoring scheme for leopards and implement it in the Range Countries to enable effective adaptive management of the species and assess population trend at a national/regional scale (populations and metapopulations).

*Action 3.1.* Develop best practice standards and methodological guidelines for leopard (and their prey) population monitoring providing reliable information on population trends at a meaningful spatial scale.

*Action 3.2.* Identify appropriate long-term reference sites that are representative for the regional conservation units (metapopulations) and define appropriate methods.

*Action 3.3.* Establish monitoring networks and build capacity to maintain long-term monitoring in the selected sites.

**Objective 4. Conflicts and coexistence:** To promote coexistence with leopards through reducing and mitigating human-leopard conflicts.

*Action 4.1.* Identify areas with a conflict level threatening the (local) survival of leopards.

*Action 4.2.* Develop in a participatory process (authorities in charge, experts, stakeholders, and local people), appropriate measures to reduce and mitigate human-leopard conflicts and implement them in close cooperation with the local communities.

**Objective 5. Trophy hunting:** To ensure that trophy hunting is sustainable and fosters conservation of leopards.

*Action 5.1.* Implement available best practice standards to ensure sustainable leopard hunting.

*Action 5.2.* Design and implement policies to ensure the revenue generated from trophy hunting contributes towards meaningful leopard conservation.

**Objective 6. Poaching of leopards and prey:** To stop leopard population decline by increasing protection.

*Action 6.1.* Train and equip enforcement teams and ensure implementation of enforcement.

*Action 6.2.* Implement SMART or other systems for threat and law enforcement monitoring and evaluation.

*Action 6.3.* Understand and mitigate local social factors driving poaching of leopards and prey.

*Action 6.4.* Develop local informant networks in communities in and around key protected leopard populations.

**Objective 7. Trade:** To stop illegal trade of leopards at national and international levels.

*Action 7.1.* Review of legislative processes (e.g. laws, policies and capacity for implementation in range states) and law enforcement systems.

*Action 7.2.* Assess legal and illegal trade in leopard parts across the range (TRAFFIC, CITES).

*Action 7.3.* Train law enforcement agents such as border guards and customs officials to combat trade in leopards.

*Action 7.4.* Design and implement outreach campaigns targeting consumer groups.

**Objective 8. Prey base conservation:** To secure and enhance wild leopard prey populations through sustainable wildlife management.

*Action 8.1.* Assess the extent and sustainability of legal prey hunting across the range.

*Action 8.2.* Design and implement sustainable hunting practices and monitoring of prey populations.

*Action 8.3.* Review control methods for crop-raiding prey and implement alternatives to lethal control.

*Action 8.4.* Supplement and restore prey populations where severely depleted or extinct.

**Objective 9. Habitat protection:** To stop and reverse destruction and fragmentation of habitat of leopard and their prey.

*Action 9.1.* Identify and protect key leopard habitat at greatest risk of conversion most likely to affect population persistence.

*Action 9.2.* Identify corridors and promote connectivity.

*Action 9.3.* Promote sustainable management of the consumption of fodder, forest products, fuel wood, etc.

**Objective 10. Capacity development:** To assemble and deliver training to practitioners that enables leopard conservation.

*Action 10.1.* Develop training modules and material for (1) monitoring of leopard and prey, (2) habitat management, (3) PA management, (4) law enforcement, (5) conflict mitigation, (6) conservation breeding.

*Action 10.2.* Develop and implement a delivery plan.

**Objective 11. Leopard partnership:** To identify and foster partnerships at global and regional level for leopard conservation.

*Action 11.1.* Evaluate network models and design and deliver an appropriate system for leopards.

*Action 11.2.* Identify a hub.

*Action 11.3.* Set up a central repository for sharing information.

## Conclusions

The Objectives and Actions listed above are those identified by the IUCN SSC Cat Specialist Group in order to provide a basis for the development of more elaborated logistic frameworks (LogFrames) for RCS or NAPs. They are based on the leopard research up to date as compiled in this *Roadmap*, and on our experience in conservation programmes for other large cats. Although each species and each Range Country has its particularities that must be considered when defining concrete *in situ* measures, the basic threats and challenges, as well as the principle solutions are very similar for large carnivores and for different regions. The joint African Carnivore Initiative of CITES and CMS – which explicitly searches the cooperation with IUCN ([UNEP/CMS/COP12/DOC.24.3.1.1](#)) – offers a unique change to also address the large-scale conservation of the leopard, which has been neglected in the shadow of the other charismatic large cats.

Furthermore, the conservation efforts under the ACI can be organised synergistically and so help to use funding more efficiently. Among many other obstacles, the availability of funding is always a main obstacle to the implementation of conservation activities. This is true for all large cats, but most prominently for *Panthera pardus*.

## References

- Abensperg-Traun M. 2009. CITES, sustainable use of wild species and incentive-driven conservation in developing countries, with an emphasis on southern Africa. *Biological Conservation* 142, 948–963.
- African Parks 2011. Annual Report 2011. 64 pp.
- African Wildlife Foundation. Limpopo Leopard Conservation Project. <http://www.awf.org/projects/limpopo-leopard-conservation> (last accessed on 17.10.2018).
- ALERT. no date. Funding Proposal. Large carnivore conservation in Kusungu NP, Malawi: population monitoring education & awareness capacity building, 10 pp.
- Alexandratos N. & Buinsma J. 2012. World agriculture towards 2030/2050. Agricultural development economics division. Food and agriculture organisation of the United Nations. 147 pp.
- Al Jumaily M., Mallon D. P., Naher A. K. & Thowabeh N. 2006. Status report on Arabian Leopard in Yemen. *Cat News Special Issue 1*, 20–25.
- Allen G., Diana K., Keppenne P., Lehman A., Schatz A. & Squillario J. 2014. Uganda. In *Empty threat: Does the law combat illegal wildlife trade? An eleven-country review of legislative and judicial approaches*. DLA Piper, pp. 232–279.
- Anderson L. 2017. CMS CoP12 concludes, lists lions, chimps, giraffe and leopards. Available at: <http://sdg.iisd.org/news/cms-cop12-concludes-lists-lions-chimps-giraffe-and-leopards/>. (accessed on 28.09.2018)
- Anonymous. no date. Fauna of Lesotho. Available at: <https://www.malibalodge.com/images/pdf/Fauna%20of%20Lesotho.pdf> (accessed on 18.10.2018).
- Anstey S. 1991. Large mammal distribution in Liberia. WWF/FDA Wildlife Survey Report March 1991. 116 pp.
- Arnett G. R. 1981. Endangered and threatened Wildlife and Plants, Threatened status for the leopard in southern Africa. Department of the Interior Fish and Wildlife Service. *Federal Register* 47, 4104–4210.
- Atickem A., Williams S., Bekele A. & Thirgood S. 2010. Livestock predation in the Bale Mountains, Ethiopia. *African Journal of Ecology* 48(14), 1076–1082.
- Balme G. 2010. Return of the leopard. *Africa Geographic*, 35–42.
- Balme G. & Hunter L. 2004. Mortality in a protected leopard population, Phinda private Game Reserve, South Africa: A population decline. *Ecological Journal* 6, 6 pp.
- Balme G., Hunter L. & Slotow R. 2007. Feeding habitat selection by hunting leopards *Panthera pardus* in a woodland savanna: prey catchability versus abundance. *Animal Behaviour* 74, 589–598.
- Balme G. A., Slotow R. & Hunter L. T. 2009. Impact of conservation interventions on the dynamics and persistence of a persecuted leopard (*Panthera pardus*) population. *Biological Conservation* 142, 2681–2690.
- Balme G. A., Slotow R. & Hunter L. T. B. 2010a. Edge effects and the impact of non-protected areas in carnivore conservation: leopards in the Phinda-Mkhuze Complex, South Africa. *Animal Conservation* 13, 315–323.
- Balme G. A., Hunter L. T., Goodman P., Ferguson H., Craigie J. & Slotow R. 2010b. An adaptive management approach to trophy hunting of leopards *Panthera pardus*: a case study from KwaZulu-Natal, South Africa. *Biology and conservation of wild felids*. Oxford University Press, Oxford, United Kingdom, 341–352.
- Balme G. A., Batchelor A., de Woronin Britz N., Seymour G., Grover M., MacDonald D. W. & Hunter L. T. B. 2012a. Reproductive success of female leopards *Panthera pardus*: the importance of top-down processes. *Mammal Review* 43, 221–237.
- Balme G. A., Hunter L. & Braczkowski A. R. 2012b. Applicability of age-based hunting regulations for African leopards. *PLOS ONE* 7, e35209.
- Balme G. A., Lindsey P. A., Swanepoel L. H. & Hunter L. T. B. 2013. Failure of research to address the rangewide conservation needs of large carnivores: leopards in South Africa as a case study. *Conservation Letters* 7(1), 3–11.
- Barnett R. & Patterson C. 2005. Sport hunting in the Southern African Development Community (SADC) Region: An overview. TRAFFIC East/Southern Africa, Johannesburg, South Africa, 115 pp.
- Becker M., McRobb R., Watson F., Droge E., Kanyembo B., Murdoch J. & Kakumbi C. 2013. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. *Biological Conservation* 158, 26–36.
- Begg C. M. & Begg K. S. 2007. Niassa Carnivore project. Mitigation of negative human impacts on carnivore populations: African wild dog, lion, leopard, spotted Hyaena. Sponsor's Report. Prepared for: Sociedade para a Gestão e Desenvolvimento da Reserva do Niassa Moçambique, 20 pp. Available at: [http://www.niassalion.org/library\\_files/2006%20NCP%20Annual%20report.doc.pdf](http://www.niassalion.org/library_files/2006%20NCP%20Annual%20report.doc.pdf) (accessed on 08.01.2016).

- Bergin D. & Nijam V. 2014. Open, unregulated trade in Wildlife in Morocco's Markets. *Traffic Bulletin* 26(1), 65–70.
- Bertram B. C. R. 1982. Leopard ecology as studied by radio tracking. *Symposium of the Zoological Society of London* 49, 341–352.
- Boast 2014. Exploring the causes of and mitigation options for human-predator conflict on game ranches in Botswana: How is coexistence possible? PhD Thesis, University of Cape Town, 312 pp.
- Boast L. K. & Houser A. 2012. Density of large predators on commercial farmland in Ghanzi, Botswana. *South African Journal of Wildlife Research* 42(2), 138–143.
- Brackzkowski A. R., Balme G. A., Dickman A., Macdonald D. W., Johnson P. J., Lindsey P. A. & Hunter L. T. B. 2015. Rosettes, Remingtons and Reputation: Establishing potential determinants of leopard (*Panthera pardus*) trophy prices across Africa. *African Journal of Wildlife Research* 45(2), 158–168.
- Brashares J. S. & Sam M. K. 2005. How much is enough? Estimating the minimum sampling required for effective monitoring of African reserves. *Biodiversity and Conservation* 14, 2709–2722.
- Breitenmoser U., Lanz T., Vogt K. & Breitenmoser-Würsten Ch. 2015. How to save the cat - Cat Conservation Compendium, a practical guideline for strategic and project planning in cat conservation. *Cat News Special Issue* 9, 36 pp.
- Brugiere D., Badjinca I., Silva C., Serra A. & Barry M. 2005. Distribution and Status of Lions and Leopards in Southern Guinea Bissau and Western Guinea, West Africa. *Cat News* 43, 14–18.
- Boulet H., Chardonnet P., Crosmary W., Ferro P., Fritz H., Pellerin M. & Plasschaert C. 2008. Carnets de brousse – suivi écologique d'espèces peu communes en Afrique Centrale et en Afrique de l'ouest – Années 2005–2008. Foundation IGF, Paris, 41 pp.
- Bureau of Statistics 2015. 2014 biodiversity and land use. Bureau of Statistics, Maseru, Lesotho, 11 pp.
- CARACAL (Centre for Conservation of African Resources: Animals Communities and Land use). no date. ODMF Wildlife Management Component. Leopard and cheetah baseline inventory in the Okavango Delta particularly in relation to areas of human wildlife conflict. Final Report. Kasane, Botswana, 141 pp.
- Caro T. & Riggio J. 2014. Conservation and behaviour of Africa's "Big Five". *Current Zoology* 60(4), 486–499.
- Caro T. M., Pelkey N., Borner M., Severre E. L. M., Campbell K. L. I., Huish S. A., Ole Kuwai J., Farm B. P. & Woodworth B. L. 1998. The impact of tourist hunting on large mammals in Tanzania: an initial assessment. *African Journal of Ecology* 36, 321–346.
- Caso A. 2002. Leopard pilot population study at Rungwa/Piti ecosystem, Tanzania, East Africa. Final report, 12 pp.
- Chapman S. & Balme G. 2010. An estimate of leopard population density in a private reserve in KwaZulu-Natal, South Africa, using camera-traps and capture-recapture models. *South African Journal of Wildlife Research* 40, 114–120.
- Chase-Grey J. N. 2011. Leopard population dynamics, trophy hunting and conservation in the Soutpansberg Mountains, South Africa. PhD thesis, Durham University, United Kingdom, 265 pp.
- Chase-Grey J. N., Kent V. T. & Hill R. A. 2013. Evidence of a high density population of harvested leopards in a montane environment. *PLoS ONE* 8(12), 11 pp.
- CITES 2018a. List of Contracting Parties. <https://cites.org/eng/disc/parties/chronolo.php> (accessed on 04.10.2018).
- CITES 2018b. Quotas for leopard hunting trophies. Interpretation and implementation matters. General compliance and enforcement. AC30 Doc. 15. Thirtieth meeting of the Animals Committee Geneva, Switzerland, 16-21 July.
- CITES 2018c. The CITES export quotas. Available at: <https://www.cites.org/eng/resources/quotas/index.php> (accessed on 17.10.2018). 27 pp.
- CITES 2018d. CITES trade statistics derived from the CITES Trade Database, UNEP World Conservation Monitoring Centre, Cambridge UK. <http://trade.cites.org/> (accessed on 08.01.2016).
- CITES 2018e. Quotas for leopard hunting trophies (*Panthera pardus*): report of the Animals Committee. SC70 Doc. 55. Seventieth meeting of the Standing Committee, Rosa Khutor, Sochi (Russian Federation), 1-5 October 2018. 33 pp.
- CITES 2018f. Results of the 'International Expert Workshop on Non-Detriment Findings for Hunting Trophies of Certain African Species Included in CITES Appendices I and II' (Seville, April 26–29, 2018). AC30 Doc. 10.2 (Rev. 1). Thirtieth meeting of the Animals Committee, Geneva (Switzerland), 16–21 July 2018. 41 pp.
- CITES 2012. Interpretation and Implementation of the Convention Trade control and marking. Leopard Export Quotas. Sixty-second meeting of the Standing Committee, Geneva (Switzerland), 23-27 July 2012. SC62 Doc. 35, 5 pp.
- CITES 2007a. Consideration of Proposals for Amendment of Appendices I and II. Fourteenth meeting of the Conference of the Parties, The Hague (Netherlands), 3–15 June 2007. CoP14, Prop. 3, 8 pp.

- CITES 2007b. Interpretation and implementation of the Convention. Trade control and marking issues. Appendix-I species subject to export quotas. Leopard export quotas for Mozambique. Fourteenth meeting of the Conference of the Parties, The Hague (Netherlands), 3–15 June 2007. CoP14 Doc. 37.1, 10 pp.
- CITES 2007c. Conference Resolution 10.14 (Rev. CoP14). Quotas for leopard hunting trophies and skins for personal use. 2 pp.
- CITES 2007d. IUCN/Traffic Analyses of the Proposals to amend the CITES Appendices. Fourteenth meeting of the Conference of the Parties, The Hague (Netherlands), 3–15 June 2007. CoP14, Inf. 13, 196.
- CITES 2007e. Proposal to seek transfer of Uganda's leopard (*Panthera pardus*) population, from Appendix I to Appendix II. Fourteenth meeting of the Conference of the Parties, The Hague (Netherlands), 3–15 June 2007. CoP14 Inf. 22, 9 pp.
- CITES 2004a. Interpretation and implementation of the Convention. Regular and special reports. Appendix-I species subject to export quotas. Leopard: export quota for Namibia. Thirteenth meeting of the Conference of the Parties, Bangkok (Thailand), 2–14 October 2004. CoP13 Doc. 19.1, 9 pp.
- CITES 2004b. Conference Resolution 10.14 (Rev. CoP13). Quotas for leopard hunting trophies and skins for personal use. 2 pp.
- CITES 2002a. Interpretation and implementation of the Convention. Regular and special reports. Appendix-I species subject to export quotas. Leopard. Amendment to the quota of the United Republic of Tanzania. Twelfth meeting of the Conference of the Parties, Santiago (Chile), 3–15 November 2002. CoP12 Doc. 23.1.2., 7 pp.
- CITES 2002b. Implementation of Decision 11.165 on trade in traditional medicines. List of species traded for medicinal purposes. Eighteenth meeting of the Animals Committee, San José (Costa Rica), 8–12 April 2002. AC18 Doc. 13.1, 12 pp.
- CITES 2002c. Conference Resolution 10.14 (Rev. CoP12). Quotas for leopard hunting trophies and skins for personal use. 2 pp.
- CITES 1997. Interpretation and Implementation of the Convention. Export of Leopard Hunting Trophies and Skins. Tenth meeting of the Conference of the Parties, Harare (Zimbabwe), 9 to 20 June 1997. Doc. 10.42, 4 pp.
- CITES 1992. Conference Resolution 8.10. Quotas for leopard hunting trophies and skins for personal use, 2 pp.
- CITES 1989a. Interpretation and Implementation of the Convention. Trade in Leopard Skins. Secretariat Report on Leopard Quotas. Seventh Meeting of the Conference of the Parties, Lausanne (Switzerland), 9 to 20 October 1989. Doc. 7.27, 3 pp.
- CITES 1989b. Conference Resolution 7.7. Quotas for leopard hunting trophies and skins for personal use, 2 pp.
- CITES 1985a. Interpretation and Implementation of the Convention. Trade in Leopard skins. Fifth meeting of the Conference of the Parties, Buenos Aires (Argentina), 22 April to 3 May 1985. Doc. 5.23, 10 pp.
- CITES 1985b. Conference Resolution 5.13. Trade in Leopard Skins, 2 pp.
- Clark K. & Begg C. 2010. African Wild Dog and Large Carnivore Survey: Selous-Niassa Wildlife Protection corridor. The United Republic of Tanzania. Ministry of Natural Resources and Tourism, Wildlife Division, Namtumbo & Tunduru District Councils, 31 pp. Available at: [http://www.niassalion.org/library\\_files/2009-Selous%20Niassa%20Wildlife%20Corridor%20Carnivore%20Survey.pdf](http://www.niassalion.org/library_files/2009-Selous%20Niassa%20Wildlife%20Corridor%20Carnivore%20Survey.pdf) (accessed on 18.10.2018).
- CMS 2018. Parties and Range States. Available at: <https://www.cms.int/en/parties-range-states> (accessed on 25.10.2018).
- CMS & UNEP 2011. Parties to the Convention on the Conservation of Migratory Species of Wild Animals and its Agreements. Available at: [https://www.cms.int/sites/default/files/document/inf\\_04\\_parties\\_e\\_0.pdf](https://www.cms.int/sites/default/files/document/inf_04_parties_e_0.pdf) (accessed on 18.10.2018)
- CMS & UNEP 2017. Proposal for the inclusion of the leopard (*Panthera pardus*) on Appendix II of the Convention. 12<sup>th</sup> Meeting of the Conference of the Parties, Manila, Philippines, 23–28 October 2017. UNEP/CMS/COP12 Doc. 25.31.4. 35 pp.
- Coad L. 2007. Bushmeat hunting in Gabon: socio-economics and hunter behavior. PhD thesis, University of Cambridge, United Kingdom, 347 pp.
- Constant N. L. 2014. A socio-ecological approach towards understanding conflict between leopards (*Panthera pardus*) and humans in South Africa: Implications for leopard conservation and farming livelihoods. PhD thesis, Durham University, United Kingdom, 298 pp.
- Craigie I. D., Baillie J. E. M., Balmford A., Carbone C., Collen B., Green R. E. & Hutton J. M. 2010. Large mammal population declines in Africa's protected areas. *Biological Conservation* 143, 2221–2228.
- Croes B., Buji R., van Dalen J. & de Iongh H. 2008. Livestock-carnivore conflicts: results of an inventory around Bénoué National Park, Cameroon. *In* Croes B., Buji R., de Iongh H. and Bauer H. International seminar on the conservation of small and hidden species. Management and conservation of large carnivores in West and Central Africa. Maroua, Cameroon, 29–40.

- Croes B. M., Funston P. J., Rasmussen G., Buij R., Saleh A., Tumenta P. N. & De longh H. H. 2011. The impact of trophy hunting on lions (*Panthera leo*) and other large carnivores in the Bénoué Complex, northern Cameroon. *Biological Conservation* 144(12), 3064–3072.
- Daly B., Power J., Camacho G., Traylor-Holzer K., Barber S., Catterall S., Fletcher P., Martins Q., Owen C., Thal T. & Friedmann Y. (Eds). 2005. Leopard (*Panthera pardus*) population and habitat viability assessment. Workshop report. Conservation Breeding Specialist Group (SSC/IUCN)/CBSG South Africa, and Endangered Wildlife Trust, 105 pp.
- de Beer P. J. 2009. The trophy hunting industry of South Africa: a proposed model to ensure its viable future. MBA thesis, University of Pretoria, South Africa, 103 pp.
- Degeorges P. A. & Reilly B. K. 2008. A critical evaluation of conservation and development in Sub-Saharan Africa “Last chance Africa”. The Edwin Mellen Press, Lewiston, New York. 7 books, 3572 pp.
- Dickman A. J., Hazzah L., Carbone C. & Durant S. M. 2014. Carnivores, culture and “contagious conflict”: Multiple factors influence perceived problems with carnivores in Tanzania’s Ruaha land-scape. *Biological Conservation* 178, 19–27.
- Di Minin, E., Leader-Williams N. & Bradshaw C. J. A. 2015. Banning trophy hunting will exacerbate biodiversity loss. 31(2), 99–102 pp.
- Di Silvestre I. & Bauer H. 2013. Population status of carnivores in Pendjari Biosphere Reserve, Benin, in 2001–2002. *Cat News* 58, 16–19.
- du Toit R. 2004. Review of wildlife issues associated with the land reform programme in Zimbabwe. WWF-SARPO, Harare, Zimbabwe, 126 pp.
- Eaton R. L. 1977. The status and conservation of the leopard in Sub-Saharan Africa. Report. Safari Club International. Tucson, Arizona, 164 pp.
- Eba’a Atyi R. & Bayol N. 2009. Les forêts de la République Démocratique du Congo en 2008. In *Les forêts du Bassin du Congo – état des forêts 2008*. de Wasseige C., Devers D., de Marcken P., Eba’a Atyi R., Nasi R. & Mayaux Ph. (eds). Office des publications de l’Union européenne, Luxembourg, Luxembourg, pp. 115–128.
- EIA (Environmental Investigation Agency) 2011a. Leopards losing out at CITES as Parties let reporting slide – August 2011. 2 pp.
- EIA (Environmental Investigation Agency) 2011b. Key features of the Asian Big Cat (ABC) skin and bone trade in China in 2005–2011. November 2011. 4 pp.
- EIA (Environmental Investigation Agency) 2015. Sin City. Illegal wildlife trade in Laos’ Golden Triangle Special Economic Zone. Washington, 24 pp.
- EIA (Environmental Investigation Agency) 2018. Wildlife. Down to the bone: China’s alarming trade in leopard bones. 6 pp.
- European Commission 2014. Larger than Elephants. Inputs for an EU strategic approach to wildlife conservation in Africa, 109 pp.
- EWCA 2012. National Action Plan for the conservation of cheetah and African wild dog in Ethiopia. Addis Ababa, Ethiopia, 45 pp.
- Fagotto F. 1985. Larger animals of Somalia in 1984. *Environmental Conservation* 12, 260–264.
- Fattebert J., Dickerson T., Balme G., Slotow R. & Hunter L. 2013. Long-distance natal dispersal in leopard reveals potential for a three-country metapopulation. *South African Journal of Wildlife Research* 43, 61–67.
- Funston P., Hanssen L. & Möller M. 2014. Large carnivore survey Bwabwata National Park, Namibia, July 2014. Report for MET in collaboration with Kwando Carnivore Project, Panthera and Kyara-macan Association, 9 pp.
- Fusari A. & Carpaneto G. 2006. Subsistence hunting and conservation issues in the game reserve of Gile, Mozambique. *Biodiversity and Conservation* 3, 137–155.
- Förster B. & Förster H. 2008. Studying cheetahs, leopards and brown hyaenas of the African savannah bushland, Namibia. Expedition Report. Okatumba Wildlife Research, Klein Windhoek, Namibia, 80 pp.
- Gandiwa E. 2011. Preliminary assessment of illegal hunting by communities adjacent to the northern Gonarezhou National Park, Zimbabwe. *Tropical Conservation Science* 4(4), 445–467.
- Grant T. 2012. Leopard population density, home range size and movement patterns in a mixed land use area of the Mangwe district of Zimbabwe. MSc Thesis. Rhodes University, 134 pp.
- Groom R. & Brand H. 2011. Carnivore Densities in Gonarezhou National Park Results of the June 2011 Spoor Survey. Unpublished report. Zimbabwe Parks and Wildlife Management Authority. Harare, Zimbabwe.
- Hall H., Puritz A., Gerrand L., Bailey Y., Griffin J. & Turnbull R. 2014. Botswana. In *Empty threat: Does the law combat illegal wildlife trade? An eleven-country review of legislative and juridical approaches*. DLA Piper, pp. 5–30.
- Hanssen L. & Stander P. 2003. Namibia Large Carnivore Atlas. Atlas Report Vol. 2, December 2003. Predator Conservation Trust, Windhoek, Namibia, 13 pp.

- Hanssen L. & Stander P. 2004. Namibia Large Carnivore Atlas. Atlas Report Vol. 1, July 2004. Predator Conservation Trust, Windhoek, Namibia, 13 pp.
- Hart T. B. 2009. A new conservation landscape for bonobo: discovery and conservation of the Tshuapa-Lomami-Lualaba Landscape, in the Democratic Republic of Congo. Final Report. Assistance Award Agreement # 98210-7-G285 U.S. Fish and Wildlife Service Great Ape Conservation Act. Lukuru Wildlife Research Foundation, Inc., 98 pp.
- Hargreaves R. 2010. The plight of wildcats in South Africa: Damaging causing animals or bycatch. *Journal of the Wildcat Conservation Legal Aid Society*, 65–74.
- Hatton J., Couto M. & Oglethorpe J. 2001. Biodiversity and war: a case study of Mozambique. WWF Biodiversity Support Program, Washington D.C.
- Hayward M. W., Henschel P., O'Brien J., Hofmeyr M., Balme G. & Kerley G. I. H. 2006. Prey preferences of the leopard (*Panthera pardus*). *Journal of Zoology* 270, 298–313.
- Henghali J. N. 2006. Conservation attitudes and patterns of biodiversity loss in the Ohangwena and Oshikoto regions of Namibia. MSc thesis, University of Namibia, Namibia, 129 pp.
- Henschel 2001. Untersuchung der Ernährungsweise und der Populationsdichte des Leoparden (*Panthera pardus*) im Lopé Reservat, Gabun, Zentralafrika. Diplomarbeit, Georg-August-Universität zu Göttingen, 45 pp.
- Henschel P. 2008. The conservation biology of the leopard *Panthera pardus* in Gabon: Status, threats and strategies for conservation. Dissertation, Georg-August-University, Göttingen, 83 pp.
- Henschel P. 2009. The status and conservation of leopards and other large carnivores in the Congo basin, and the potential role of reintroduction. In *Reintroduction of top-order predators*. Hayward M. W. & Somers M. J. (eds.). Blackwell Publishing Ltd, Chichester, United Kingdom, pp. 206–237.
- Henschel P. & Ray J. 2003. Leopards in African Rainforests: survey and monitoring techniques. *Wild-life Conservation Society Global Carnivore Program*, 54 pp.
- Henschel P., Abernethy K. A. & White L. J. T. 2005. Leopard food habits in the Lopé National Park, Gabon, Central Africa. *African Journal of Ecology* 43, 21–28.
- Henschel P., Hunter L., Breitenmoser U., Purchase N., Packer C., Khorozyan I., Bauer H., Marker L., Sogohossou E. & Breitenmoser-Würsten C. 2008. *Panthera pardus*. The IUCN Red List of Threatened Species. Version 2014.3. <http://www.iucnredlist.org/details/15954/0> (Last accessed on: 20.04.2015).
- Henschel P., Hunter L. T. B., Coad L., Abernethy K. A. & Mühleberg M. 2011. Leopard prey choice in the Congo Basin rainforest suggests exploitative competition with human bushmeat hunters. *Journal of Zoological Society London* 285, 11–20.
- Henschel P., Malanda G.-A. & Hunter L. 2014. The status of savanna carnivores in the Odzala-Kokoua National Park, northern Republic of Congo. *Journal of Mammalogy* 94, 882–892.
- Herschman J., Damianos E., Diana K. F., Goetzl L. G. & Lennon S. H. 2014. Democratic Republic of the Congo. In *Empty threat: Does the law combat illegal wildlife trade? An eleven-country review of legislative and judicial approaches*. DLA Piper, pp. 74–98.
- Hicks T. C. 2010. A chimpanzee mega-culture? Exploring behavioral continuity in *Pan troglodytes schweinfurthii* across northern DR Congo. PhD thesis, University of Amsterdam, Netherlands, 303 pp.
- Holmern T., Nyahongo J. & Roskaft E. 2007. Livestock losses caused by predators outside the Serengeti National Park, Tanzania. *Biological Conservation* 135, 518–526.
- Holst B., Ahmed A., Aouled A. A., Mohamed A. A., Laurent A., Aman A. M., Desbiez A., Mulot B., Lafrance B., Gibault C., Mallon D., Ruivo E., Rayaleh H. A., Leus K., Moehlmann P. & McGowan P. 2013. Conserving Djibouti's Priority Land Animals – A seminar and Conservation Workshop, Cerd, Djibouti.
- Hunter L. & Barrett P. 2011. *A Field guide to the Carnivores of the World*. New Holland Publishers Ltd. London, 240 pp.
- Hunter L. & Balme G. no date. The leopard: the world's most persecuted big cat. *Conservation in Action* 88–94.
- Ikemeh A. R. 2007. Okomu leopard survey – a preliminary assessment of the status and distribution of leopards in Okomu Forest Reserve, south-western Nigeria. Ogba Zoological Garden and Nature Reserve, Benin City, Edo State, Nigeria, 30 pp.
- ISTEEBU (Institut des statistiques et d'études économiques du Burundi) 2016. *Annuaire statistique de Burundi 2014*. ISTEEBU, Bujumbura, Burundi, 284 pp.
- IUCN SSC Cat Specialist Group. 2006a. *Conservation Strategy for the Lion in West and Central Africa*. IUCN, Yaounde, 44 pp. Available in English and French. [http://www.catsg.org/fileadmin/filesharing/3.Conservation\\_Center/3.4.Strategies\\_Action\\_Plans/African\\_lion/IUCN\\_CatSG\\_2006\\_West\\_and\\_Central\\_Africa\\_Lion\\_Conservation\\_Strategy.pdf](http://www.catsg.org/fileadmin/filesharing/3.Conservation_Center/3.4.Strategies_Action_Plans/African_lion/IUCN_CatSG_2006_West_and_Central_Africa_Lion_Conservation_Strategy.pdf) (accessed on 01.10.18).

- IUCN SSC Cat Specialist Group. 2006b. Conservation Strategy for the Lion in East and Southern Africa. Johannesburg, South Africa, 55 pp.  
[http://www.catsg.org/fileadmin/filesharing/3.Conservation\\_Center/3.4.Strategies\\_Action\\_Plans/African\\_lion/IUCN\\_CatSG\\_2006\\_East\\_and\\_South\\_Africa\\_Lion\\_Conservation\\_Strategy.pdf](http://www.catsg.org/fileadmin/filesharing/3.Conservation_Center/3.4.Strategies_Action_Plans/African_lion/IUCN_CatSG_2006_East_and_South_Africa_Lion_Conservation_Strategy.pdf) (accessed on 01.10.18).
- IUCN-SSC. 2007. Regional Conservation Strategy for the Cheetah and African Wild Dog in Eastern Africa. Gland, Switzerland. 83 pp.
- IUCN SSC 2012a. IUCN SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland.
- IUCN-SSC. 2012b. Regional Conservation Strategy for the Cheetah and African Wild Dog in Western, Central and Northern Africa. Gland, Switzerland.
- IUCN-SSC. 2015. Review of the Regional Conservation Strategy for the Cheetah and African Wild Dog in Southern Africa. IUCN/SSC, Gland, Switzerland and Range Wide Conservation Program for Cheetah and African Wild Dogs, [www.cheetahandwilddog.org](http://www.cheetahandwilddog.org).
- IUCN SSC. 2017. End of the year report – December 2017. 48 pp. [https://www.iucn.org/sites/dev/files/content/documents/iucn\\_ssc\\_quarterly\\_report\\_dec2017\\_hd.pdf](https://www.iucn.org/sites/dev/files/content/documents/iucn_ssc_quarterly_report_dec2017_hd.pdf)
- IUCN – SSC Species Conservation Planning Sub-Committee. 2017. Guidelines for Species Conservation Planning. Version 1.0. Gland, Switzerland: IUCN. xiv + 114 pp
- IUCN SSC Cat Specialist Group 2018. Guidelines for the Conservation of Lions in Africa. Version 1.0. Muri/Bern, Switzerland 191 pp.
- Jackson P. 1989. A review by leopard specialists of The status of leopard in Sub-Saharan Africa by Martin and de Meulenaer. Information document – Submitted to the 7th meeting of the conference of the Parties to CITES Lausanne (Switzerland), 9–20 October 1989. IUCN Cat Specialist Group, Bougy, Switzerland, 11 pp.
- Jacobson A. P., Gerngross P., Lemeris Jr J. R., Schoonover R. F., Anco C., Breitenmoser-Würsten C., Durant S. M., Farhadinia M. S., Henschel P., Kamler J. F., Laguardia A., Rostro-García S., Stein A. B. & Dollar L. 2016. Leopard (*Panthera pardus*) status, distribution, and the research efforts across its range. PeerJ, 4, e1974.
- Jenny D. 1996. Spatial organization of leopards *Panthera pardus* in Taï National Park, Ivory Coast: Is rainforest habitat a “tropical haven?” *Journal of Zoology*, London 240, pp. 427–440.
- Jones T. 2013. Predictors of mammal distribution and abundance in afro-montane forests of the Udzungwa Mountains, Tanzania. PhD thesis, Anglia Ruskin University, United Kingdom, 226 pp.
- Jorge A. A. 2012. The sustainability of leopard *Panthera pardus* sport hunting in Niassa National Reserve, Mozambique. Thesis: University of KwaZulu-Natal Westville, South Africa, 84 pp.
- Jorge A. A., Vanak A. T., Thaker M., Begg C. & Slotow R. 2013. Costs and benefits of the presence of leopards to the sport-hunting industry and local communities in Niassa National Reserve, Mozambique. *Conservation Biology* 27, 832–843.
- Judas J., Paillat P., Khoja A. & Boug A. 2006. Status of the Arabian leopard in Saudi Arabia. *Cat News Special Issue* 1, 11–19.
- Kane M. D. 2014. Estimating population size, density, and occupancy of lions (*Panthera leo*), leopards (*Panthera pardus*), and servals (*Leptailurus serval*) using camera traps in the Niokolo Koba National Park in Senegal, West Africa. MSc Thesis, Virginia Polytechnic Institute and State University, 121 pp.
- Kane M., Morin D. & Kelly M. 2015. Counting cats at the northern extreme of their range: preliminary population assessment of lions, leopards, and servals in Niokolo-Koba National Park, Senegal. *Wild Felid Monitor*, 8, 12–17.
- Kent V. T. 2011. The Status and Conservation Potential of Carnivores in Semi-Arid Rangelands, Botswana. The Ghanzi Farmlands: A Case Study. Durham University.
- Kenya Wildlife Service 2012. Annual Carnivore Research and Conservation. Conference Proceedings 36 pp.
- Kenya Wildlife Service, no date a. Amboseli Ecosystem Management plan 2008–2018. Amboseli Ecosystem Stakeholders and KWS Biodiversity Planning, Assessment & Compliance Department, KWS Protected Areas Planning Framework, 160 pp.
- Kenya Wildlife Service, no date b. Hell’s Gate-Mt. Longonot Ecosystem Management plan 2010–2015. Hell’s Gate/Mt. Longonot National Park Managers and KWS Biodiversity Planning and Environmental Compliance Department. KWS Management planning Standard Operating Procedures, 56 pp.
- Kenya Wildlife Service no date c. Kiunga-Boni-Dodori Conservation Area Management Plan (KBDCA) 2013–2023. KBDCA Managers, KBDCA Stakeholders and KWS Planning & Environmental Compliance Department. KWD Protected Areas Planning Framework, 151 pp.



- Kenya Wildlife Service no date d. Meru Conservation Area Management Plan 2007–2017. MCA Managers, MCA Stakeholders, KWS Biodiversity Planning Department. KWS Protected Areas Planning Framework, 187 pp.
- Kenya Wildlife Service no date e. Mt Kenya Ecosystem Management Plan 2010–2020. MKE Managers, MKE Stakeholders, Protected Areas Planning Framework, 139 pp
- Kenya Wildlife Service no date f. Ruma National Park Management Plan 2012–2017. Ruma National Park Managers and KWS Biodiversity Planning and Environmental Compliance Department. KWS Planning Standard Operating Procedures, 78 pp.
- Kenya Wildlife Service no date g. Tsavo Conservation Area Management Plan 2008–2018. 211 pp.
- Kerth G., Gusset M., Garbley J., König B., Gabanapelo T. & Schiess-Meier M. 2013. Conservation Genetic Resources 5, 1101–1105.
- Kgalagadi Leopard Project n.d. <https://de-de.facebook.com/KgalagadiLeopards/> (last accessed on 17.10.2018).
- Kitchener A. C., Breitenmoser-Würsten Ch., Eizirik E., Gentry A., Werdelin L., Wilting A., Yamaguchi N., Abramov A., Christiansen P., Driscoll C., Duckworth W., Johnson W., Luo S.-J., Meijaard E. O'Donoghue P., Sanderson J., Seymour K., Bruford M., Groves C., Hoffmann M., Nowell K., Timmons Z. & Tobe S. 2017. A revised taxonomy of the Felidae. The final report of the Cat Classification Task Force of the IUCN Cat Specialist Group. *Cat News Special Issue 11*, 88 pp.
- Kuhn B. F. 2014. A preliminary assessment of the carnivore community outside Johannesburg, South Africa. *South African Journal of Wildlife Research 44*(1), 95–98.
- Kuloba B. 2012. Annual Carnivore Researchers and Conservation Conference Proceedings 26–27 July 2012. Kenya Wildlife Service, 36 pp.
- Leo Foundation no date. Large Carnivore Initiative. <http://leofoundation.org/en/projects/the-large-carnivore-initiative/> (accessed on 24.10.2018).
- LCMAN Large Carnivore Management Association of Namibia. <http://www.carnivore-namibia.org/work.html> (accessed on 17.10.2018).
- Leader-Williams N. & Hutton J. M. 2005. Does extractive use provide opportunities to offset conflicts between people and wildlife? In Woodroffe R., Thirgood S., Rabinowitz A., (Eds.), *People and Wildlife: Conflict or Co-existence?* Cambridge University Press, Cambridge, U.K. 140–161.
- Lemeris J. Jr. 2013. Identifying areas of socio-ecological value for the translocation of perceived conflict cheetah (*A. jubatus*) and leopard (*P. pardus*) in Namibia. MSc thesis, Nicholas School of the Environment of Duke University, North Carolina, U.S.A., 41 pp.
- Leopard Conservation Project. <http://www.leopardconservation.co.za/> (last accessed on 17.10.2018).
- Lindsey P. A. 2008. Trophy hunting in sub Saharan Africa: Economic Scale and Conservation. *Best Practices in Sustainable Hunting*, 41-47.
- Lindsey P. & Bento C. 2012. Illegal hunting and the bushmeat trade in Central Mozambique: A case-study from Coutada 9, Manica Province. *TRAFFIC East/Southern Africa*, Harare, Zimbabwe, 84 pp.
- Lindsey P. A. & Chikerema-Mandisodza R. 2012. Preliminary report for leopards in Zimbabwe. *TRAFFIC Southern Africa*, 27 pp.
- Lindsey P. A., Roulet P. A. & Romañach S. S. 2007. Economic and conservation significance of the trophy hunting industry in Sub-Saharan Africa. *Biological Conservation 134*, 455–469.
- Lindsey P. A., Romanach S. S. & Davies-Mostert H. T. 2009. A synthesis of early indicators of the drivers of predator conservation on private lands in South Africa. In *Reintroduction of top-order predators*. Hayward m.W. & Somers M.J. (Eds.). Blackwell Publishing, 325–344.
- Lindsey P. A., Marnewick K., Balme G. & Swanepoel L. 2011a. Non-Detriment Finding Assessment for the trophy hunting of leopards in South Africa. *Workshop 7–8 December 2010*. 39 pp.
- Lindsey P. A., Romañach S. S., Tambling C. J., Chartier K. & Groom R. 2011b. Ecological and financial impacts of illegal bushmeat trade in Zimbabwe. *Oryx 45*(1), 96–111.
- Lindsey P. A., Havemann C. P., Lines R., Palazy L., Price A. E., Retief T. A., Rhebergen T. & van der Waal C. 2013a. Determinants of persistence and tolerance of carnivores on Namibian Ranches: implications for conservation on Southern African Private Lands. *PLOS ONE 8*(1), 14 pp.
- Lindsey P. A., Barnes J., Nyirenda V., Pumfrett B., Tambling C. J., Taylor W. A. & 't Sas Rolfes. 2013b. The Zambian wildlife ranching industry: scale, associated benefits, and limitations affecting its development. *PLOS ONE 8*(12), e81761.
- Lindsey P. A., Nyirenda V. R., Barnes J. I., Becker M. S., McRobb R., Tambling C. J., Taylor W. A., Watson F. G. & 't Sas-Rolfes M. 2014. Underperformance of African Protected Area Networks and the case for new conservation models: insights from Zambia. *PLOS ONE 9*(5), e94109.
- Lindsey P., Balme G., Becker M., Begg C., Bento C., Bocchino C., Dickman A., Diggle R., Eves H., Henschel P., Lewis D., Marnewick K., Mattheus J., McNutt J. W., McRobb R., Midlane N., Milanzi J., Morley R., Murphree M., Nyoni P., Opyene V., Phadima J., Purchase N., Rentsch D., Roche C., Shaw JI., van der Westhuizen H.,

- Van Vliet N. & Zisadza P. 2015. Illegal hunting and the bush-meat trade in savanna Africa: drivers, impacts and solutions to address the problem. FAO, Panthera/Zoological Society of London/Wildlife Conservation Society report, New York. 79 pp.
- Loveridge A. J. 2009. Ecological Sustainability of leopard trophy hunting in Zimbabwe. Darwin Initiative –Final Report, 34 pp.
- Loveridge A. J., Kuiper T., Parry R. H., Sibanda L., Hunt J. H., Stapelkamp B., Sebele L. and Macdonald D. W. 2017. Bells, bomas and beefsteak: complex patterns of human-predator conflict at the wildlife-agropastoral interface in Zimbabwe. *PeerJ* 5: e2898, 29 pp.
- Maddox T. M. 2003. The ecology of cheetahs and other large carnivores in a pastoralist-dominated buffer zone. PhD thesis, University of London, United Kingdom, 373 pp.
- Mann G., Pitman R., Whittington-Jones G., Thomas L., Broadfield J., Taylor J., Rogan M. & Balme G. 2018. South African Leopard Monitoring Project. Final report for the South African National Biodiversity Institute. March 2018. Panthera & South African National Biodiversity Institute. 17 pp.
- Maputla N. W., Chimimba C. T. & Ferreira S. M. 2013. Calibrating a camera trap-biased mark-recapture sampling design to survey the leopard population in the N'wantesi concession, Kruger National Park, South Africa. *African Journal of Ecology* 51(3), 422–430.
- Martin R. B. & de Meulenaer T. 1988. Survey of the status of the leopard (*Panthera pardus*) in Sub-Saharan Africa. CITES Secretariat, Lausanne, Switzerland, 106 pp.
- Martinez Marti C. 2011. The leopard (*Panthera pardus*) and the golden cat (*Caracal aurata*) in Equatorial Guinea: a national assessment of status, distribution and threat. Panthera and Conservation International, 80 pp.
- Martins Q. E. 2010. The ecology of the leopard *Panthera pardus* in the Cederberg Mountains. PhD Thesis, University of Bristol, 132 pp.
- Martins Q. & Harris S. 2013. Movement, activity and hunting behavior of leopards in the Cederberg mountains, South Africa. *African Journal of Ecology* 51(4), 571–579.
- Matho L. 2011. Gabon: 13 ape heads, 32 ape hands, 12 leopard skins, 1 lion skin, 5 elephant tails – and 5 dealers behind bars! Available at: <http://www.africanconservation.org/wildlife-news/gabon-13-ape-heads-32-ape-hands-12-leopard-skins-1-lion-skin-5-elephant-tail-and-5-dealers-behind-bars-2> (accessed on 18.10.2018)
- Mauck G. 2013. Wildlife Legislation in Sub-Saharan Africa : Criminal Offences. 101 pp.
- Médard P., Traoré M. V. & Berins R. 2010. Rapport d'enquête recensement des observations de guépards et autres carnivores dans les aires protégées de l'ouest du Burkino Faso. Espacénature environnement, Zoo d'Amnéville, Safari de Peaugres, Zoo de Dou, 53 pp.
- Melletti M., Mirabile M., Penteriani V. & Boitani L. 2011. Habitat use by forest mammals in Dzanga-Ndoki National Park, Central Africa Republic. *African Journal of Ecology* 47(4), 797-800.
- Mendelsohn J. 2006. Farming systems in Namibia. A publication for the Namibia National Farmers Union (NNFU). Research & Information Services of Namibia, Windhoek, Namibia, 82 pp.
- MINUA (Ministerio do urbanismo e ambiente de Angola) 2006. Primeiro Relatório Nacional para a Conferência das Partes da Convenção da Diversidade Biológica. Projecto 00011125 – Estratégia e Plano de Acção Nacionais para a Biodiversidade. Luanda, Angola, 100 pp.
- Mizutani F. 1999. Impact of leopards on a working ranch in Laikipia, Kenya. *African Journal of Ecology* 37, 211–225.
- Monk A., Anderson A., Furness A., Rhodes V. & Russel E. 2014a. Kenya. In Empty threat: Does the law combat illegal wildlife trade? An eleven-country review of legislative and judicial approaches. DLA Piper, pp. 99–127.
- Monk A., Bailey Y., Craig V., Kappel J., Lange S., Law K., Lloyd B. & Wilton C. 2014b. Tanzania. In Empty threat: Does the law combat illegal wildlife trade? An eleven-country review of legislative and judicial approaches. DLA Piper, pp. 207–231.
- Morake P. 2010. Documenting historical faunal change in Lesotho and the adjoining Eastern Free State of South Africa. Witwatersrand Institutional Repository on DSpace (wiredspace): collections of electronic Thesis and Dissertations. Available at: <http://wiredspace.wits.ac.za/bitstream/handle/10539/8561/Master%20Dissertation%20.pdf?sequence=3> (accessed on 16.02.2016).
- Msuhia M. J. 2009. Human impacts on carnivore biodiversity inside and outside protected areas in Tanzania. PhD thesis, University College London and Institute of Zoology, Zoological Society London, 234 pp.
- Myers 1976. For the leopard's lovers, good news. For the Cheetah's, bad. The New York Times. 21pp.
- NCP (Niassa Carnivore Project) 2012. Annual Report 2012. 62 pp. Available at: [http://www.niassalion.org/library\\_files/2012FULL.pdf](http://www.niassalion.org/library_files/2012FULL.pdf) (accessed on 18.10.2018).

- NCP (Niassa Carnivore Project) 2013. Annual report 2013. 99 pp. Available at: [http://www.niassalion.org/library\\_files/2013%20NCP%20Annual%20Report%20-FINAL.pdf](http://www.niassalion.org/library_files/2013%20NCP%20Annual%20Report%20-FINAL.pdf) (accessed on 18.10.2018).
- NCP (Niassa Carnivore Project) 2014. Annual report 2014. 113 pp. Available at: [http://www.niassalion.org/library\\_files/2014%20NCP%20Annual%20report%20-Final.pdf](http://www.niassalion.org/library_files/2014%20NCP%20Annual%20report%20-Final.pdf) (accessed on 18.10.2018)
- NORAD (Norwegian Environmental Action Plan Baseline Study) 2009. 5. Malawi Data. Evaluation Department, Oslo, Norway, 36–42 pp. Available at: <http://www.oecd.org/derec/norway/44502549.pdf> (accessed on 18.10.2018)
- Norton P. M. 1986. Conservation plan for Cape mountain leopard population. Draft Report IUCN Cat Specialist group, 2 pp.
- Norton P. 1990. How many leopards? A criticism of Martin and de Meulenaer's population estimates for Africa. *South African Journal of Science* 86, 218–220.
- Nowell K. & Jackson P. (Eds) 1996. *Wild cats: status survey and Conservation Action Plan*. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland, 382 pp.
- Nowell K. & Pervushina N. 2014. Review of implementation of Resolution Conf. 12.5 (Rev. Cop16) on conservation of and trade in tigers and other Appendix-I Asian Big Cat Species. Report to the CITES Secretariat for the 65th meeting of the Standing Committee.
- N/a'an ku sê Conservation through Innovation. <http://www.naankuse.com/wildlife-conservation/carnivore-conservation.html> (accessed on 17.10.2018).
- Obank R., Schatz A., Flick A., Heading A., Kuzmierkiewicz S. & Brookes E. 2015. *Empty threat 2015: Does the law combat illegal wildlife trade? A Review of Legislative and Judicial Approaches in Fifteen Jurisdictions*. DLA Piper, 296 pp.
- O'Brien T. G. & Kinnaird M. F. 2011. Density estimation of sympatric carnivores using spatially explicit capture-recapture methods and standard trapping grid. *Ecological Applications* 21(8), 2908–2916.
- Odden M., Athreya V., Ratten S. & Linnell J. D. C. 2014. Adaptable Neighbours: Movement Patterns of GPS-Collared Leopards in Human Dominated Landscapes in India. *PLoS ONE* 9(11), 1–9.
- Ogada M. O., Woodroffe R., Oguge N. O. & Frank L. G. 2003. Limiting depredation by African Carnivores: the role of livestock husbandry. *Conservation Biology* 17(6), 1521–1530.
- Okello M. M., Kiringe J. W. & Warinwa F. 2014a. Human-Carnivore Conflicts in Private Conservancy Lands of Elerai and Oltiyani in Amboseli Area, Kenya. *Natural Resources* 5, 375–391 pp.
- Okello M. M., Bonham R. & Hill T. 2014b. The pattern and cost of carnivore predation on livestock in maasai homesteads of Amboseli ecosystem Kenya: insights from a carnivore compensation pro-gramme. *International Journal of Biodiversity and Conservation* 6(7), 502–521.
- Olupot W., McNeilage A. J. & Plumtre A. J. 2009. An analysis of socioeconomics of bushmeat hunting at major hunting sites in Uganda. *WCS Working Paper No. 38*, 95 pp.
- Ott T., Kerley G. I. H. & Boshoff A. F. 2007. Preliminary observation on the diet of leopards (*Panthera pardus*) from a conservation area and adjacent rangelands in the Baviaankloof region, South Africa. *African Zoology* 41(1), 31–37.
- Owen C., Niemann S. & Slotow R. 2010. Copulatory parameters and reproductive success of wild leopards in South Africa. *Journal of Mammalogy* 91(5), 1178–1187.
- Packer C., Kosmala M., Cooley H.S., Brink H., Pintea L., Garshelis D., Purchase G., Strauss M., Swanson A., Balme G., Hunter L. & Nowell K. 2009. Sport hunting, predator control and conservation of large carnivores. *PLOS ONE* 4 (6), e5941.
- Packer C., Brink H., Kissui B. M., Maliti H., Kushnir H. & Caro T. 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. *Conservation Biology* 25(1), 142–153.
- Palazy L., Bonenfant C., Gaillard J.-M. & Courchamp F. 2011. Cat Dilemma: Too protected to escape trophy hunting? *PLOS ONE* 6 (7), 7 pp.
- Panthera 2018a. Leopards: Conservation by country. <https://www.panthera.org/leopards-conservation-country> (accessed on: 18.10.2018)
- Panthera 2018b. Panthera's faux fur leopard project. <https://www.panthera.org/furs-for-life> (accessed on: 17.10.2018).
- Panthera & ZPWMA 2018. Establishing a national monitoring framework to enable adaptive management of leopards in Zimbabwe. 5 pp.
- Patterson B. D., Kasiki S. M., Selempo E. & Kays R. W. 2004. Livestock predation by lions (*Panthera leo*) and other carnivores on ranches neighboring Tsavo National Parks, Kenya. *Biological Conservation* 119 (4), 507–516.

- Pitman R. T. 2012. The conservation biology and ecology of the African leopard *Panthera pardus pardus*. The Plymouth Student Scientist 5(2), 581–600.
- Purchase G., Mateke C. & Purchase D. 2007. A review of the status and distribution of carnivores, and levels of human-carnivore conflict, in the protected areas and surrounds of the Zambezi Basin. The Zambezi Society, Bulawayo, Zimbabwe, 79 pp.
- Ray R.-R. 2011. Ecology and population status and the impact of trophy hunting of the leopard *Panthera pardus* (Linnaeus, 1758) in the Luambe National Park and surrounding Game Management Areas in Zambia. PhD Thesis, Rheinische Friedrich-Wilhelms-Universität. Düsseldorf, 196 pp.
- Ray J. C., Hunter L. & Zigouris J. 2005. Setting conservation and research priorities for larger African carnivores. Working Paper No. 24. Wildlife Conservation Society, New York, U.S.A., 203 pp.
- Raza H. A., Ahmad S. A., Hassan N. A., Ararat K., Qadir M. & Ali L. 2012. First photographic record of the Persian leopard in Kurdistan, northern Iraq. *Cat News* 56, 34–35.
- Republic of Botswana 2012. 2012 State of the Nation Address. Available at: <http://www.gov.bw/en/Ministries--Authorities/Ministries/State-President/Office-of-the-President/Tools--Services/Speeches-/2012-State-of-the-Nation-Address/> (accessed on 18.10.2018).
- Republic of Kenya 2013. The Wildlife Conservation and Management Act. Kenya Gazette Supplement No. 181 (Acts No. 47). Special Issue, 27th December. Nairobi, Kenya, 116 pp.
- Romañach S. S., Lindsey P. A. & Woodroffe R. 2007. Determinants of attitudes towards predators in central Kenya suggestions for increasing tolerance in livestock dominated landscape. *Oryx* 41(2), 185–195.
- Sanei A., Mussavi M., Kiabi B. H. Z., Zehi A. B., Masoud M. R., Mohamadi H. & Jafaari B. 2015. Status assessment of the Persian leopard in Iran. *Cat News Special Issue* 9, 43–50.
- Schiess-Meier M., Ramsauer S., Gabanapelo T. & König B. 2007. Livestock Predation – insights from Problem Animal Control Registers in Botswana. *Journal of Wildlife Management* 71(4), 1267–1274.
- Shashe Limpopo Predator Research Group. 2010. The status of large carnivores of the greater Mapungubwe Transfrontier Conservation Area: 2004–2010. Shashe Limpopo Predator Research Group. Bulawayo, Zimbabwe.
- Simasiku P., Simwanza H. I., Tembo G., Bandyopadhyay S. & Pavy J.-M. 2008. The impact of wildlife management policies on communities and conservation in Game Management Areas in Zambia. Message to policy makers. National Resources Consultative Forum, Lusaka, Zambia, 37 pp.
- Smithers R. H. N. 1971. The Mammals of Botswana. National Museums of Rhodesia, 340 pp.
- South Sudan Wildlife Service 2010. National Action Plan for the conservation of cheetahs and African wild dogs in South Sudan, 45 pp.
- Spalton A. & Al Hikmani H. 2014. The Arabian Leopards of Oman. Diwan of Royal Court of the Sultan-ate of Oman and Stacy Publishing Ltd. London, 160 pp.
- Stein A. B. 2008. Ecology and conservation of the leopard (*Panthera pardus* Linnaeus 1758) in North-central Namibia. PhD Thesis, University of Massachusetts, 215 pp.
- Stein A. B. & Hayssen V. 2013. *Panthera pardus* (Carnivora: Felidae). *Mammalian Species* 45(900), 30–48.
- Stein A. B., Fuller T. K., De Stefano S. & Marker L. L. 2011. Leopard population and home range estimates in north-central Namibia. *African Journal of Ecology* 49, 383–387.
- Stein A., Andreas A. & Aschenborn O. 2012. Namibian National Leopard Survey – 2011. Final Report, 41 pp.
- Stein A. B., Athreya V., Gerngross P., Balme G., Henschel P., Karanth U., Miquelle D., Rostro-Garcia S., Kamler J. F., Laguardia A., Khorozyan I. & Ghoddousi A. 2016. *Panthera pardus*. (errata version published in 2016) The IUCN Red List of Threatened Species 2016: e.T15954A102421779. Downloaded on 27 September 2018.
- Steinmetz R., Seuaturien N. & Chutipong, W. 2013. Tigers, leopards, and dholes in a half-empty forest: Assessing species interactions in a guild of threatened carnivores. *Biological Conservation* 163, 68–78.
- Strampelli P. 2015. Status and habitat use responses of leopard (*Panthera pardus*) in a human impacted region of rural Mozambique. MSc thesis, Imperial College London. 64 pp.
- Sunquist M. E. & Sunquist F. 2002. *Wild Cats in the World*. University of Chicago Press. London, 462 pp.
- Svengren H. & Bjoerklund M. 2010. An assessment of the density of a large carnivore using a non-invasive method adapted for pilot studies. *South African Journal of Wildlife Research* 40(2), 121–129.
- Swanepoel L. H. 2008. Ecology and conservation of leopards, *Panthera pardus*, on selected game ranges in Waterberg region, Limpopo, South Africa. Thesis, University of Pretoria, 158pp.
- Swanepoel L. H., Lindsey P., Somers M. J., van Hoven W. & Dalerum F. 2013. Extent and fragmentation of suitable leopard habitat in South Africa. *Animal Conservation* 16, 41–50.

- Swanepoel L. H., Lindsey P., Somers M. J., van Hoven W. & Dalerum F. 2014. The relative importance of trophy harvest and retaliatory killing of large carnivores. South African leopards as a case study. *South African Journal of Wildlife Research* 44(2), 115–134.
- Swanepoel L. H., Somers M. J. & Dalerum F. 2015. Functional Responses of Retaliatory killing versus recreational sport hunting of leopards in South Africa. *PLOS ONE* 10(4), e0125539.
- TAWIRI (Tanzania Wildlife Research Institute) 2007. Proceedings of the first Tanzania Lion and Leopard Conservation Action Plan Workshop. TAWIRI, Arusha, Tanzania, 50 pp.
- TAWIRI (Tanzania Wildlife Research Institute) 2009. Tanzania lion and leopard Conservation Action Plan. In *Tanzania Carnivore Conservation Action Plan*. TAWIRI, Arusha, Tanzania, pp. 64–111.
- The Africat Foundation. No date. The Africat predator population density study in the Okonjima Nature Reserve. <https://okonjima.com/africat-okonjima-predator-population-density-study-phase-5/> (accessed on 25.10.2018).
- The Embassy of the Republic of Angola in Washington D.C. No date. Tourism. <http://www.angola.org/index.php?page=tourism> (accessed on 18.10.2018).
- Thorn M., Green M., Scott D. & Marnewick K. 2013. Characteristics and determinants of human carnivore conflict in South African farmland. *Biodiversity and Conservation* 22, 1715–1730.
- TEAM Network no date. Tropical Ecology Assessment & Monitoring Network . <http://www.teamnetwork.org/network/sites/pasoh-national-forest> (last accessed on: 11.09.2015).
- Toni P. & Lodé T. 2013. Fragmented populations of leopards in West-Central Africa: Facing an uncertain future. *African Zoology* 48(2), 374–387.
- UICN/PACO 2010. Parcs et réserves de la République Démocratique du Congo: évaluation de l'efficacité de gestion des aires protégées. UICN Programme Afrique Centrale et Occidentale, Ouagadougou, Burkina Faso, 148 pp.
- UN 2013. World Population Prospects, the 2012 revision. New York: Department for Economic and Social Affairs.
- UNEP-WCMC 2013. CITES Trade - A global analysis of trade in Appendix I-listed species. UNEP-WCMC, Cambridge, United Kingdom, 82pp.
- UWA Uganda Wildlife Authority 2010. Strategic Action Plan for Large Carnivore Conservation in Uganda 2010–2020. UWA, Panthera and Wildlife Conservation Society, 68 pp
- UWA (Uganda Wildlife Authority) 2012. Strategic Action Plan for large carnivore conservation in Uganda. Uganda Wildlife Authority, Kampala, Uganda, 68 pp.
- Van der Waal C. & Dekker B. 2000. Game ranching in the Northern Province of South Africa. *South African Journal of Wildlife Research* 15, 218–227.
- van Krunkelsven E., Bila Isia I. & Draulans D. 2000. A survey of bonobos and other large mammals in the Salonga National Park, Democratic Republic of Congo. *Oryx* 34, 180–187.
- Vanleeuwe H., Henschel P., Péliissier C., Moyer D. & Gotanegre A. 2009. Recensement des grands mammifères & impacts humains. Parc Nationaux de l'Upemba & des Kundelungu. République Démocratique du Congo, Février 2009. Financé par U.S. Fish and Wildlife Service, 31 pp.
- van Schalkwyk, R. 2014. Four decades of NAPHA. *HuntiNamibia*, Venture Publications, Windhoek, Namibia, pp 12–17.
- Waterland S., Vaughan J., Lyman E. & Jurisic I. 2015. *Illegal Wildlife Trade Review*, Malawi. German International Cooperation, 249 pp.
- White P. A. & Belant J. L. 2015. Provisioning of game meat to rural communities as a benefit of sport hunting in Zambia. *PLOS ONE*, 10(2), e0117237.
- Wilkie D. S. & Carpenter J. F. 1999. Bushmeat hunting in the Congo Basin: an assessment of impacts and options for mitigation. *Biodiversity and Conservation* 8, 927–955.
- Willcox A. S. 2002. *The Extirpated Ark: the status of hunting in the Banyang-Mbo Wildlife Sanctuary of southwest Cameroon*. MSc thesis, Durrell Institute of Conservation and Ecology, Canterbury, United Kingdom.
- Williams S. T., Williams K. S., Joubert C. J. & Hill R. A. 2016. The impact of land reform on the status of large carnivores in Zimbabwe. *PeerJ* 4:e1537, 21 pp.

- Williams S. T., Williams K. S., Lewis B. P & Hill R. A. 2017. Population dynamics and threats to an apex predator outside protected areas: implications for carnivore management. *Royal Society Open Science* 4: 161090.
- Winterbach H. E. K., Winterbach C. W., Somers M. J. & Hayward M. W. 2013. Key factors and related principles in the conservation of large African carnivores. *Mammal Review* 43, 89–110.
- Wilson V. J. 2006. Survey of the distribution and status of leopard (*Panthera pardus*) & cheetah (*Acinonyx jubatus*) in Zimbabwe. Chipangali Wildlife Trust, Carnivore Research Institute & Zimbabwe Parks and Wildlife Authority, 21 pp.
- Yihune M., Bekele A. & Tefera Z. 2009. Human–wildlife conflict in and around the Simien Mountains National Park, Ethiopia. *SINET: Ethiopian Journal of Science* 32(1), 57–64.
- Yirga G. & Bauer H. 2011. Farmers' perception of leopard (*Panthera pardus*) conservation in a human dominated landscape in Northern Ethiopian Highlands. *Mediterranean Journal of Social sciences* 2, 95–102.
- Zambian Carnivore Programme 2015. <http://www.zambiacarnivores.org/> (accessed on 17.10.2018)
- Zeiss B. 1998. Ökologie und Nutzungspotentiale von Leoparden (*Panthera pardus*) in der Waterberg-Region, Namibia. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn, 63 pp.
- Zimparks (Zimbabwe Parks & Wildlife Management Authority). 2015. <http://www.zimparks.org/index.php/about-us/profile> (accessed on 08.01.16).